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THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

THE SELECTIVE SIGNIFICANCE OF REASONING ABILITY TESTS

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In February and March, 1906, tests in reasoning ability were given to 757 children from whom complete records were gotten in the fourth, fifth, and sixth school grades of Passaic, New Jersey. The full treatment of these tests and their immediate results are found in *The Reasoning Ability of Children of Fourth Fifth, and Sixth School Grades*, by the writer, Bureau of Publications, Teachers College. After nine years, a period which would practically insure that all of these children who would complete a high school course had accomplished that end, a study of what had become of them was made. The purpose was to discover whether the distribution and success of the individual pupils indicated any selective significance in the results of the reasoning ability tests.

Through the courtesy and co-operation of the Superintendent of Schools, Principal of the High School, and Principals of the schools in which the tests were made in Passaic, the full school record of those finishing eighth grade and those entering high school have been secured, excluding those only who removed from Passaic. A record of the fact of leaving school before finishing eighth grade for those who dropped out of the grades has also been gotten. The plan as comprehended at the outset included following up children after leaving school to note occupational successes or failures, and to consider these in relationship to the results of the tests. So far, this has not been accom-

plished. An attempt by correspondence failed most ingloriously. Of 225 brief blanks sent out with return postage paid but fifteen were returned. It is hoped to pursue this part of the study through personal visitation to a more satisfactory conclusion, the results of which will be made available when secured.

But the facts of distribution and correlation from the results now at hand are of interest and significance. The children discussed in this paper are distributed as shown in Table I. Since nothing but the mere fact of having left school, or "left school to go to work," is available for those 237 boys and 224 girls who did not finish eighth grade, 100 of each were taken by random selection for consideration and are designated as the "Left school" group. The 100 of each sex taken are nearly one half of the respective groups and are certainly representative of them. Pupils entering the high school but not graduating are designated throughout as "H.S. nongraduates." Those designated as "8th grade graduates" are those finishing eighth grade but not entering high school.

TABLE I.

Distribution of Children Studied

	Boys		Girls		Totals	
	Number	Per cent.	Number	Per cent.	Number	Per cent.
Total	385	50.86	372	49.14	757	100.00
H. S. graduates	51	13.24	49	13.17	100	13.21
H. S. nongraduates	49	12.72	51	13.70	100	13.21
8th grade Grades	48	12.46	48	12.90	96	12.68
Left school	100	25.97	100	26.88	200	26.42

On the basis of these groupings, the selections made by the school system itself, arrays were made of the results of the original tests for the total or combined resultant of all of the individual parts of the test, and those of the mathematical and opposites tests. The median ability of the respective groups, and, for comparison, the median ability of all of the pupils taken together, follow in Table II. The gradation of median ability of the respective groups from the "Left school" to the "H.S. graduates" is almost startling in its differences.

On the basis of the median ability for the entire group of boys and of girls, Table III shows the percentage in each of the respective groups above the median ability of all, and also above the median ability as measured upon the basis of the grade

TABLE II.

Median Ability of the Four Groups in Test Results

	Totals		Math. Tests		Opposites	
	Boys	Girls	Boys	Girls	Boys	Girls
For all	165.83	159.25	22.60	17.75	88.93	93.00
H. S. graduates	193.00	200.00	25.00	23.00	98.75	101.50
H. S. nongraduates	171.50	146.00	24.00	14.00	93.50	90.25
8th grade Graduates	166.50	156.50	22.00	16.00	90.00	89.00
Left school	149.00	153.00	20.00	17.50	79.50	88.00

TABLE III.

Percentage in Each Group Above the Median Ability of All

	Boys		Girls	
	Basis of all	Grade basis	Basis of all	Grade basis
H. S. graduates	72.52	70.56	79.58	77.55
H. S. nongraduates	55.09	57.13	35.29	45.09
8th grade graduates	54.15	52.06	49.99	47.91
Left school	31.00	41.00	42.00	42.00

TABLE IV.

	On basis of all				On grade basis			
	Boys Numbers							
Quartiles	1	2	3	4	1	2	3	4
H. S. graduates	2	12	18	19	7	8	11	25
H. S. nongraduates	11	17	17	10	8	13	17	11
8th grade graduates	13	9	16	10	13	10	13	12
Left school	37	32	16	15	28	31	29	12
	Percentages							
H. S. graduates	3.9	23.5	35.3	37.2	13.7	15.7	21.6	49.0
H. S. nongraduates	22.4	22.4	34.7	20.4	16.3	26.5	34.7	22.4
8th grade graduates	27.1	18.7	33.3	20.8	27.1	20.8	27.1	24.9
Left school	37.0	32.0	16.0	15.0	28.0	31.0	29.0	12.0
	Girls Numbers							
H. S. graduates	5	5	11	28	6	5	13	25
H. S. nongraduates	17	16	5	13	14	14	13	10
8th grade graduates	12	12	16	8	14	11	16	7
Left school	27	31	26	16	33	25	25	17
	Percentages							
H. S. graduates	10.2	10.2	22.4	57.1	12.2	10.2	26.5	51.1
H. S. nongraduates	33.3	31.4	9.8	25.5	27.5	27.5	25.5	19.6
8th grade graduates	25.0	25.0	33.3	16.6	29.2	22.9	33.3	14.6
Left school	27.0	31.0	26.0	16.0	33.0	25.0	25.0	17.0

distribution. In the original study, each respective grade was treated as a unit, all fourth grade boys together, all fifth grade boys together, and so on, as well as considering all boys and all girls as respective groups. Rating all boys together gives a median slightly higher than that of fourth grade boys and slightly lower than that of sixth grade boys. Table III shows percentages on the basis of median ability computed from both arrays.

A comparison of these percentages by either array points clearly the selective force at work in the school system on the basis of ability measured by the tests. For boys graduating from high school, but 13.7 per cent., by the grade array, come from the lowest quartile in ability while 49.0 per cent. come from the highest quartile. Of those leaving school before finishing the eighth grade, 28.0 per cent. come from the lowest quartile, and but 12.0 per cent. from the highest. From Table III, on the basis of all, it is seen that 72.5 per cent. of the high school graduate boys were above the median ability shown in the tests; of the high school boys who did not graduate, 55.1 per cent.; of the eighth grade graduates who did not enter high school, 54.2 per cent.; and of those leaving before finishing the eighth grade but 31.0 per cent. For girls the trend is about the same, but the percentage above median ability is notably greater for high school girl graduates. There is, however, to be noted here and in Table 1, a degree of ability for girls entering high school but not graduating less than that of girls finishing the eighth grade but not entering high school. The median ability by the tests of the group of high school girls not graduating is 146.0 while that of the eighth grade graduating group not entering high school is 156.5. The only explanation suggesting itself is, that entering high school for girls is not so much a matter of ability as for boys, but is more a matter of "going with the crowd." With nothing else to offer as entertaining or profitable occupation, the girl of relatively low ability may often enter high school, only to fall by the way when the work taxes her limited capacity beyond the point of pressure which she is willing or able to endure.

A very marked drop in ability is noted in passing from the groups finishing the elementary school to the group dropping out of the grades. By combining the results of all of those who finish eighth grade, including those entering high school, and comparing this total with that of those leaving school in the

grades, this difference is clearly brought out. Table V makes this comparison, first by quartile distribution, then by combining the quartiles below and above the median respectively, using the basis of array for all.

TABLE V.

Percentages by Quartiles and Halves of Combined Groups

Quartiles	1	2	3	4
	Boys			
All finishing eighth grade	17.6	21.6	34.5	26.3
Left school	37.0	32.0	16.0	15.0
	Girls			
All finishing eighth grade	22.9	22.3	21.6	33.1
Left school	27.0	31.0	26.0	16.0

Combining lower quartiles and upper quartiles respectively:

	Boys		Girls	
	Below M.	Above M.	Below M.	Above M.
All finishing eighth grade	39.2	60.8	45.3	54.7
Left school	69.0	31.0	58.0	42.0

Variability as measured by the coefficient of variability is found to be lowest in the group of high school graduates, and, in general, to increase in passing to groups of less total ability, as shown by the tests. Table VI shows the coefficients of variability for all of the boys and all of the girls respectively, and for each of the four groups in total ability, in the mathematics test, and in the opposites test.

TABLE VI.

Coefficients of Variability for All and for the Four Groups.

	Totals		Math. test		Oppos. test		Averages	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
For all	.22	.21	.26	.39	.18	.13	.22	.24
H. S. graduates	.13	.13	.26	.27	.12	.05	.17	.15
H. S. nongraduates	.21	.26	.21	.47	.15	.16	.19	.29
8th grade graduates	.24	.18	.32	.47	.19	.14	.25	.26
Left school	.24	.19	.34	.39	.22	.14	.27	.24

With respect to the particular interest in these results for the high school, the most significant feature is that of the evidence here shown that the high school tends toward the selection of students whose minds constitute a very definite type, and that this type is that which may be identified by the reasoning ability tests used with these groups three or four years before the begin-

ning of the high school period. The girls who enter high school but who do not graduate constitute a group of very high variability. Reference has been made to the relatively large number in this group who come from the lowest quartile of ability. This would, in part, account for the high variability of this group. For the variability in the totals of the tests, the variability of boys is equal to or greater than that of girls in all groups excepting that of the high school nongraduates. In the opposites test it is higher for all boys excepting in this group. In the mathematics test it is higher for girls in all groups. Reference to variability will be made again in connection with correlation of results in the tests and high school markings.

High School Ratings

Complete ratings of courses passed for every student who attended high school are on record, and for all of these included among the children studied averages have been made. Failures are not recorded. Passing marks are by the use of letters, which, with the use of the plus sign, divide passing grades into seven groups, rated in value at from 3 to 9 inclusive. While differences in ability as shown by these marks are somewhat difficult to measure, even with this scale and the omission of all failures from the record, the summary of ratings of the two groups show differences in ability of significant magnitude. The averages in terms of the scale used in the marking system, together with coefficients of variability, are shown in Table VII.

TABLE VII.

High School Ratings and Variability

	Boys		Girls	
	Averages	Cot. of Var.	Averages	Cot. of Var.
H. S. graduates	4.71	.25	5.42	.20
H. S. nongraduates	4.00	.22	4.70	.30

Age and Grade Distribution at the Time of Making the Tests

To discover whether the age at which the tests were given had any bearing upon results, and likewise whether school grade indicated any significant difference, arrays of all pupils entering high school were made on the basis of the age and grade of the pupils when the tests were given. The median ability in the tests and the high school averages of these age and grade groups are shown in Table VIII.

TABLE VIII.

Age and Grade Distribution When Tests Were Given

	Age Distribution			
	Boys		Girls	
	Under 11	11 or over	Under 11	11 or over
Number	55	45	54	46
Median of totals	179.00	182.00	155.50	195.50
H. S. averages	4.33	4.52	4.66	4.07
	Grade Distribution			
	Below G. VI	Grade VI	Below G. VI	Grade VI
Number	58	42	66	34
Median of totals	171.50	197.50	151.00	208.00
H. S. averages	3.75	4.07	4.41	4.36

By the age distribution it is seen that those who were older when the tests were given show a higher median ability, and that the older boys show a slightly higher high school average. The average of the older group of girls, however, is lower than that of the younger group. Results from the grade distribution are almost parallel. The selective element in the school system, and the fact that in the sixth grade the effects of school training has made the tests a little less valid as native ability tests than in lower grades, would lead one to expect just such results as these arrays have demonstrated. That the high school record of these older girls did not fulfill the promise of their high median ability in the tests may be explained on the basis of the fact that school training had somewhat invalidated the tests, and that, for girls, this age is a period of maximal mental growth and acuity in the somewhat rhythmic periodicity in development. While the girls made markedly better median ratings than the boys at this age they were as markedly lower in the earlier period. Further reference to the significance of age and grade distributions will be made in discussing correlations.

Individual Correlations

Naturally the first interest in correlation is whether ability as shown in the tests is correlative with ability as shown by high school ratings. Table IX gives the coefficients of correlation, by the method of unlike signs, of the three arrays of high school students, the groupings into graduates and nongraduates, the age distribution, and the grade distribution, using the totals of the tests with the high school ratings.

TABLE IX.

Correlation of Test Totals and High School Averages

	Boys		Girls	
	r	P.E.	r	P.E.
H. S. graduates	—.179	.09	+.130	.09
H. S. nongraduates	—.394	.08	—.179	.09
Under 11 years	+.307	.08	+.537	.07
11 years or over	—.114	.10	+.076	.11
Below Grade VI	+.134	.09	+.550	.06
Grade VI	+.089	.11	+.260	.11

Further correlations have been derived, using the high school ratings and the mathematics and opposites tests, two of the most significant tests in the full series used. The results follow in Table X.

TABLE X.

Correlations of High School Averages with Mathematics and Opposites Tests

	H. S. Av. and Math.				H. S. Av. and Opposites			
	Boys		Girls		Boys		Girls	
	r	P.E.	r	P.E.	r	P.E.	r	P.E.
H. S. graduates	+.318	.08	+.037	.09	—.388	.08	+.110	.09
H. S. nongraduates	—.037	.09	+.107	.09	—.110	.09	+.178	.09

While grouping the students as graduates and nongraduates gives a negative correlation of high school averages and totals, except for the graduate girls, the groupings by age and grade give positive correlations for all except boys over eleven years of age. However, because of the low degree of correlation and the relatively high probable error, these are insignificant excepting for the lower age and grade groupings. In the groups under eleven years, and also below the sixth grade, the correlations are much higher than for the older and upper grade groups, and are large enough to be really significant. These facts of correlation suggest that the species of general ability measured by the tests given is probably more appropriately to be found in children under eleven years than later, a majority of which children will be found below the sixth grade. As was noted in the original study, and in a preceding paragraph, the validity of these tests seems to diminish somewhat as we apply them above the fifth grade.

Reference to Table VIII shows that the high school average of girls tested before the age of eleven is higher than for those of eleven, and of girls below the sixth grade higher than of those

in sixth grade. In addition to the factors already noted which might, in part, account for this condition, there is the possibility that the high school has recently exercised a more exacting selection on the basis of ability than earlier. The growing opportunities for both boys and girls to secure work within the more recent years may have attracted many pupils away from school who would have continued under earlier conditions. That the correlation of test results and high school averages is higher for both boys and girls tested below the sixth grade suggests that the tests may well be given early, in fourth or fifth grade, if they are to be of most value in educational guidance.

While the correlations as a whole are perhaps less conclusive than one may have anticipated, it is not without a feeling of confidence in the validity of the tests that we note that the correlation between test results and high school averages for pupils tested under eleven years of age is + .307, P.E. .08, for boys, and + .537, P.E. .07, for girls. The median abilities of the respective groups shown in Table II, and of the quartiles in ability from which the several groups come shown in Tables III and IV, indicate that the type of ability measured by the tests is a very significant index of the selective function which is exercised by the school system as now organized in holding and eliminating pupils.

That we might know what effect the grouping determined by the selective function of the school system would have upon correlations between different elements in the series of tests themselves, correlations were made for these new groupings between test totals and the mathematics test, totals and opposites, and mathematics and opposites. For comparison, the average correlations found in the original study by combining the correlations of both age and grade distributions for the whole number of boys and of girls, respectively, are indicated at the right of these correlations. Results are shown in Table XI.

Of the twenty-four correlations, seventeen are higher than the average correlations for all pupils in the tests in the original arrays. The selection producing this distribution is clearly more definitely based upon differences in a type of ability than age or elementary school grading will show. This grouping removes the array much further from a natural distribution.

TABLE XI.

Correlation of Test Results for the Four Groups

	H. S. grad's	H. S. nongrad's	8th grade grad's	Left school	Av. for all orig. study
			Boys		
Totals and mathematics	+.50	+.67	+.83	+.66	+.53
Totals and opposites	+.95	+.84	+.92	+.90	+.87
Math. and opposites	+.55	+.57	+.75	+.19	+.41
			Girls		
Totals and mathematics	+.57	+.74	+.92	+.71	+.64
Totals and opposites	+.80	+.85	+.92	+.73	+.83
Math. and opposites	+.67	+.70	+.71	+.45	+.47
			Averages		
Boys	+.67	+.69	+.83	+.58	+.60
Girls	+.68	+.76	+.85	+.63	+.65

The groups of high school graduates and those leaving school before finishing the eighth grade show a general tendency toward lower correlation than either the high school nongraduates or the eighth grade graduates. For the high school graduates and the left school groups respectively, the correlations are + .68 and + .61, while those of the high school nongraduates and the eighth grade graduates are + .73 and + .84 respectively. The average for the groups extreme in ability is + .64 and for the median groups, + .78. There is apparent, therefore, a tendency toward specialization of ability in those whose total general ability is most remote from median ability, both above and below.

Rather definite sex differences are apparent in these correlations. Of the twelve pairs of correlations, eight are higher for girls, one is the same for both boys and girls, and three are higher for boys. The correlations of high school averages and test results, Table IX, shows that, in nine of the ten cases, the correlation is higher for girls than for boys. The coefficient of variability in high school averages is .25 for boys, .20 for girls. In general, the results show that variability, as measured by the quartile coefficient, is low where correlation is low, and high where correlation is high. Reference to Table VI in comparison with Table XI will show this. The average variability for the extreme groups, Table VI, is .21, average correlation for the corresponding groups, Table XI, is + .64; for the median groups, variability .25, correlation + .78. From Table VI, it is found that the ratio of variability of boys to girls is 1.133 for the high

school graduates, and 1.125 for the group leaving school before finishing eighth grade; while for the group of high school non-graduates the ratio is .633, and for the eighth grade graduates .961. The average ratio of boys to girls for the extreme groups is 1.129, for the median groups, .797.

The results of correlation and variability taken together indicate that the tests are measures of a species of general ability that is less broken up by specialized aspects or varieties varying in intensity in girls than in boys if the total ability is remote from the median, either above or below; that the reverse is true for groups of more nearly median ability; and that in both boys and girls the tendency is greater toward the breaking up of general ability into varieties or aspects differing in quantitative significance in the groups of extreme ability, either high or low, than in those of median ability on the basis of a natural or total distribution. In so far as this is true, the general conclusion that boys are more variable in mental ability than girls in a natural distribution loses any value it may have in application to individuals or selected groups unless their place in a scale of general ability is known. While the data here used are by no means adequate to establish broad generalizations, the question arises whether the conclusion that boys are more variable than girls may not be derived from a failure to give adequate weight to cases of extremes, a conclusion true enough for selected groups at both ends of the scale, but invalid for the groups clustering about the median in a natural distribution.

The Tests as a Basis of Probability of School Attendance

For the individual child, it is of much significance to know what chance or probability he has for reaching various grades or levels in the general school system. On the basis of the tests and the subsequent progress of the 754 children, results show that a prediction may be made for any pupil that is much more than a random guess. If the pupil falls within any respective quartile of ability as shown by the tests, in fourth, fifth, or sixth grade, what are the chances that he will finish the eighth grade? That he will enter high school? That he will finish the high school course? Table XII shows the chances in 100, based upon the performance of the 754 children, of reaching these several grades of school attainment when found in each of the respective quartiles of ability.

TABLE XII.

Probability Expressed as Chances in One Hundred

When found in one of the four quartiles of ability, the chances in 100 are, respectively:

Quartiles	1	2	3	4
Of finishing eighth grade:				
Boys	29.1	32.3	42.7	49.9
Girls	36.6	32.3	45.1	45.1
Of entering high school:				
Boys	15.6	21.9	29.1	37.5
Girls	21.5	20.4	27.9	37.6
Of finishing high school:				
Boys	7.3	8.3	11.5	26.0
Girls	6.5	5.4	13.9	26.9
Of finishing eighth grade but not entering high school:				
Boys	13.5	10.4	13.5	12.5
Girls	15.0	11.8	17.2	7.5
Of entering high school by those finishing eighth grade:				
Boys	53.6	67.7	68.3	75.0
Girls	58.8	63.3	61.9	83.3
Of finishing high school by those who enter:				
Boys	46.6	38.1	39.3	69.4
Girls	30.0	26.3	50.0	71.4

Without reference to ability, the chances in 100 for reaching the various grades of attainment are:

	Finish G. VIII	Enter H. S.	Finish H. S.	Finish G. VIII but not enter H. S.	Enter H. S. but not finish
Boys	38.4	25.9	13.2	12.5	12.7
Girls	39.8	26.9	13.2	12.9	13.7

Expressed as multiples, it is seen that pupils in the highest quartile of ability have chances greater than those in the lowest quartile as follows:

Of finishing the eighth grade:
Boys, 1.7 times greater; girls, 1.2 times greater.
Of entering high school:
Boys, 2.4 times greater; girls, 1.7 times greater.
Of finishing high school:
Boys, 3.5 times greater; girls, 4.1 times greater.

For boys, considering all quartiles of ability, the greater the ability the greater the chance of reaching the respective grades of attainment. For girls, this is true with the exception of those in the second quartile of ability. Girls just below median

ability have chances slightly lower than those in the lowest quartile of ability. After entering high school, there is also an exception for boys to the general statement. Those entering high school who come from the lowest quartile have a greater chance to finish than those coming from the second and third quartiles. For girls, the better chance of those in the lowest quartile may lie in the possible opportunity for work greater for the girl of median ability than the one just below median ability. Not securing work so readily, some girls of low ability may continue in school as an occupation with social satisfactions in preference to idleness, even at the cost of much mental effort.

Just what it may be worth to know that the tests enable us to say that a given boy in one of these middle grades has 3.5 times as great a chance of finishing high school as another given boy, or that one has 26 chances in 100, the other but 7.3 in 100, may not be wholly clear. Yet thus placing the boys in this relative position, and knowing the part this element plays in the complex selective process of the school, we might reasonably count it a distinctly tangible factor with which to work in educational guidance. We may at least say that we have taken a long step from the situation which made any prediction a mere guess toward a prediction based upon data that is scientific so far as it goes. To say that a boy has general ability which makes it seem probable that he will go to high school and finish the course is altogether less scientific and satisfactory than to say that the chances are 26 in 100 that he will do so. Of two boys, to say that the chances of one to enter and finish high school are 3.5 times greater than those of the other is far more illuminating and scientific than to say that one will probably finish high school and the other will probably not.

Conclusion

This study of the relationship between test results in the grades and subsequent school performance, incomplete as it is, seems sufficiently positive in its bearings to lend much encouragement to the hope for easily and quickly applied tests whose results are significant for educational guidance. If, by one hour's time devoted to testing a group of fourth grade children, however large the group, and the additional few hours required to grade and array the results, we shall be able to identify those of the

type of ability attracted by and successful in the academic high school, we shall have established a basis for a really scientific treatment of the problem of partial differentiation in school work. We shall be able not only to offer greater opportunities for the best development of the group ranking highest in the tests, but likewise so to modify school offerings as to give other children appropriate opportunities not now fully provided in upper grades and high school.

The tests in full with directions for giving, grading, and arraying results are found in the study referred to in the opening paragraph of this paper. Superintendents and teachers are privileged to have copies of the test papers made in quantity for class room use. The data from the 754 cases are in such forms that they may be readily combined with results from any number of additional children. The addition of several thoussand cases would aid materially in further establishing the validity of the tests or in revealing their limitations.

ORAL AND SILENT READING

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In the psychology of reading the striking differences between reading orally and reading silently have often been noted, but comparatively little beyond measuring the difference in speed seems to have been done. Theoretically the difference between the two processes is in itself interesting and it becomes more so when we consider the indirect bearing that it may have upon our educational procedure in the instruction of reading. Romanes, Quantz, Huey, and Abell,[1] have given us results on the rapidity of reading both silent and oral. Pintner[2] has discussed the factors of inner speech that seem to play an important part in silent reading, emphasizing the fact that habits acquired in oral reading were carried over to silent reading and may lessen the efficiency of silent reading. Work with school children in the grades has been done by Pintner and Mead.[3]

With fourth grade children Pintner found that silent reading was the most economical. The children read faster and retained per unit of time more of the material read. Mead with sixth grade children comes to practically the same conclusion showing that "each class reproduced a greater percentage of possible points by the silent method of reading than by the oral method."

In the present study we have attempted to extend the scope of this work in order to obtain a comparison of oral and silent reading at different grades in the elementary and high schools and also in college. The rate of reading and the amount reproduced were taken into consideration. We have therefore a

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[1] ROMANES. *Mental Evolution in Animals.*
QUANTZ, J. O. *Problems in the Psychology of Reading.* Psych. Rev. Mon. Supp. Vol II. 1897.
HUEY. *The Psychology and Pedagogy of Reading.* 1900.
ABELL, A. *Rapid Reading.* Educat. Rev. vol. 8. 1894.

[2] PINTNER, R. *Inner Speech During Silent Reading.* Psych Rev. vol. 20. No. 2, March, 1913. p. 130.

[3] PINTNER, R. *Oral and Silent Reading of Fourth Grade Pupils.* Jour. of Ed. Psych. vol. IV. No. 6. June, 1913. pp. 333–337.
MEAD, C. W. *Silent vs. Oral Reading with One Hundred Sixth Grade Children.* Jour. of Ed. Psych. vol. VI. June, 1915. Cf. also JUDD, C. H. *Measuring the Work of the Public Schools.* Cleveland Education Survey. 1916.

comparison between oral and silent reading at different stages of development and an attempt has been made to determine which is the most economical (1) for time, (2) for reproduction, and (3) for general results.

The Method of Procedure

Sets of twelve cards were prepared upon each of which a paragraph was typewritten. Each paragraph contained about fifty words and seven distinct ideas. The cards were prepared in pairs of about the same difficulty and on subjects of different interests. Each card of a pair was on a topic similar to the other card but not enough like it to be confusing.

One set of cards was used for the third and fourth grades, another for the fifth and sixth, another for the seventh and eighth grades, another for the high school, and another set of sixteen cards was used with the college students. These different sets were suited to the ability of the grades using them. The first set of paragraphs was selected from magazine articles with the idea of equal difficulty, number of words, and number of definite ideas. The other sets were made partly from new material and partly from a changed wording of the original paragraphs suiting them to the ability of the readers. The seven distinct ideas were determined when the passage was selected and marked by placing a period under the essential word or group of words representing each distinct ideas. These marks, of course, did not appear on the card shown to the reader. In the sample below, the words are set off by vertical lines. This method of marking was used because neither the number of words nor the same grammatical forms were to be reproduced but only the same ideas. The following is a sample of the paragraphs used. It is one of the set used in the third and fourth grades.

The Amazon | is the longest river in the world. It drains most of the northern half | of South America. Its mouth is along the equator. | The rubber tree grows in this river valley | and the few people who live there spend most of their time making gum.

The following number of persons were tested: 30 of the 3–4 grades, 30 of the 5–6 grades, 20 of the 7–8 grades, 20 high school pupils, and 30 college students, making in all 1680 selections read or 840 read aloud containing 5880 points and the same number read silently.

Realizing that the method of determining the points in the paragraph was entirely arbitrary, the first half of each group, *i. e.*, the first 15 of the 3–4 grades, for example, read the odd numbered selections aloud and the others silently, while the second half of the group read the odd selections silently and the even selections aloud. This method tended to equalize the varying degree of difficulty that would naturally remain in spite of the most careful selection of material. The same person gave all the tests, taking the time required to read each selection, and graded all the papers, thereby securing uniformity of method. The papers were graded according to the number of ideas reproduced. Anything that seemed to indicate that the reader had grasped and remembered the passage was counted correct. No attention was paid to bad composition or grammar.

Starch[4] has proposed to determine the comprehension by counting the number of words written which correctly reproduce the thought. It seemed to us that no advantage was gained by first going over the passage and determining which words correctly reproduced the thought and then counting the number of words. Whether the words reproduce the thought or not has to be subjectively determined by either method. Again the same thought may be expressed correctly in few or many words, and it does not by any means follow that the many-worded expression is the better. There seems therefore to be no advantage in this more complicated method.

The following instructions were given to the reader: "I have here a paragraph that I want you to read *once only*. After you have read it over once aloud (or silently) you are then to write down all the ideas you can remember that you have read, not necessarily in the exact words used in the paragraph but just so you get all the ideas."

After grading each selection by counting the number of ideas reproduced in each case, this number was divided by the time in seconds required to read the paragraph, giving the per cent. of an idea gained per second, for example, if five ideas were reproduced from a paragraph and it took fifteen seconds to read the selection it would be expressed as 33.3%. This method was adopted in order to combine both the time and the ideas into one value and we have called this value the "Reading value."

[4] STARCH, DANIEL. *The Measurement of Efficiency in Reading, Writing, Spelling, and English.* Madison, Wis. 1914.

Results

The individual records for each observer cannot be printed here because of the large number tested. Our tables show the averages of the twelve passages read for each observer.

Time. Table I shows the average time for each observer for reading the twelve passages. The upper half of the table gives the times for reading aloud and the lower half for reading silently. Under each heading (college, h. s., 7–8 grades, etc.) there are two columns. The first gives the averages for the individuals who began with selection I aloud and then alternated, aloud and silent, for the rest of the selections. The second column gives the averages for those who began with selection I silently and then alternated, *i. e.*, read silently those passages which the first group had read aloud. This same classification appears in Tables II and III.

It will be seen that the average time for the different grades varies slightly inasmuch as the lower grades on the whole take longer than the higher ones. This merely indicates that the passages for the lower grades may have been relatively a little harder than those for the higher grades. But this difference is not vital to our problem. Our real interest lies in a comparison of the general averages for reading aloud and silently. The college students read faster silently, taking on the average 13.0 seconds for the silent passages and 15.4 sec. for the aloud passages. The same is also true of the high school pupils, here the difference being 17.4 silent and 18.0 aloud. The other three groups show no advantage as regards time for silent reading. In two groups (grades 5–6 and 3–4) the general average is about the same and in the third group, grades 7–8, the average time for reading aloud is less than for reading silently. This would seem to suggest that increase in rapidity of reading comes relatively late and that with children silent reading differs from oral reading merely in the fact that the words are not pronounced aloud and there may be in this silent reading almost as much articulation as in oral reading. Only later in life with more practice in reading are the motor concomitants of silent reading shortened leading to an increase in the speed of reading. Looking at the actual number of individuals who read quicker silently we find that all the college students, with the exception of two, fall within this group and the difference between the time for

TABLE I.

Average Time Required for each Individual to Read the Twelve Paragraphs

READING TIME ALOUD

No. of Observer	College		High School		Grades 7 and 8		Grades 5 and 6		Grades 3 and 4	
	1	2	1	2	1	2	1	2	1	2
1	11.5	14.3	17.0	21.0	8.7	15.7	22.7	14.8	14.5	21.0
2	13.6	17.0	18.0	17.0	15.7	15.3	17.0	18.5	17.5	19.5
3	12.5	16.4	16.0	19.5	15.2	26.4	17.3	20.7	17.4	22.8
4	15.6	14.0	17.0	19.5	14.7	23.3	17.7	14.9	25.7	16.3
5	15.5	18.0	17.0	17.0	18.4	15.4	16.0	14.0	16.3	18.2
6	15.5	14.7	15.5	13.5	12.3	16.6	17.0	21.5	18.2	28.5
7	16.0	16.5	16.0	18.0	24.0	17.2	16.0	22.3	14.8	27.0
8	15.0	16.5	17.5	21.0	16.3	13.1	16.0	18.7	15.3	19.5
9	14.0	16.7	21.5	21.7	9.2	15.0	17.5	23.0	15.3	19.7
10	13.0	14.0	19.7	17.3	11.0	16.7	18.0	13.0	21.2	23.5
11	13.0	13.2					16.0	16.0	13.7	27.3
12	17.4	15.4					23.0	33.3	14.8	17.0
13	19.6	15.0					12.7	21.0	16.0	28.0
14	15.7	18.6					14.0	19.0	24.7	27.0
15	14.7	20.3					16.4	22.5	28.0	18.3
Average	14.8	16.0	17.5	18.5	14.5	17.5	17.1	19.5	18.2	22.2
Gen. Avge.	15.4		18.0		16.0		18.4		20.2	

READING TIME SILENTLY

1	11.3	9.7	20.1	19.5	11.7	14.7	22.5	14.3	13.0	21.5
2	13.0	13.5	20.0	23.0	15.8	23.3	12.0	19.1	13.5	26.3
3	13.0	14.1	13.2	15.0	15.3	25.3	17.5	17.5	15.3	24.0
4	13.0	10.3	16.3	14.0	15.5	27.0	17.5	18.5	27.0	15.2
5	13.0	13.0	19.3	16.7	20.5	15.5	18.7	17.2	16.3	13.1
6	16.7	8.3	15.7	12.5	15.3	17.5	15.5	20.7	10.7	26.0
7	14.0	13.0	13.3	14.9	24.3	26.0	15.3	20.0	15.5	23.2
8	14.7	12.0	14.5	18.2	19.7	16.5	15.0	20.1	13.5	19.5
9	10.5	13.4	24.0	20.0	14.2	14.0	22.5	22.0	13.0	21.0
10	10.9	10.0	18.0	21.1	15.5	14.0	19.0	17.3	18.5	28.0
11	11.0	10.0					22.3	17.7	13.3	31.0
12	18.0	11.6					23.7	29.5	15.1	16.0
13	21.4	12.7					10.7	17.7	18.3	36.0
14	14.0	12.0					11.6	18.5	24.7	24.5
15	13.6	19.0					18.3	21.3	27.1	27.0
Average	13.9	12.2	17.4	17.4	16.8	19.4	17.5	19.4	17.0	23.5
Gen. Avge.	13.0		17.4		18.1		18.5		20.2	

oral and silent reading of these two individuals is neglible, being 0.2 and 0.6 sec. respectively. Of the high school pupils 60 per cent. do better silently. In the lower grades the percentages are 14, 56, and 50, showing in the last two groups about an equal number who do better by each method.

Points Reproduced

Table II shows the average number of points reproduced for each individual and the general average for each group.

Comparing the general average for each group we see a decided uniformity in the amount reproduced by both methods. In every group about the same amount is reproduced whether the passage is read aloud or silently. The added reinforcement of the memory that, it might be argued a priori, ought to be shown because of the added auditory stimulus when reading aloud, is not apparent. Similarly we find no basis for any belief in the idea that the auditory stimulus leads to a distraction of the attention and thus results in less being remembered. It does not seem to matter as far as reproduction is concerned whether a passage is read aloud or silently.

The Reading Value

The combination of the two factors of speed and reproduction is given in the reading value, expressing the per cent. of a point reproduced per second of the reading time. Table III gives the average for each individual and the general average for the groups.

For the college group the reading value for silent reading is much higher than for oral. For silent it is 38.4 as compared with 33.5 for oral, making a difference of 4.9 in favor of silent reading. For the high school group we have 25.2 for silent and 23.6 for oral or a difference of 1.6 in favor of silent. For the next two groups, grades 7–8 and grades 5–6, the average for the silent method is very slight being 0.6 and 0.8 respectively, and lastly for grades 3–4 the values for both methods are exactly the same. These figures would seem to indicate an increasing advantage for silent reading as the individual grows older.

The results may also be looked at from another angle. If we count the number of individuals in each group who do better by each method we have the following results. Omitting those who did equally well by both methods we find that six out of

TABLE II.

Average Number of Points Reproduced

Reading Aloud

No. of Observer	College		High School		Grades 7 and 8		Grades 5 and 6		Grades 3 and 4	
	1	2	1	2	1	2	1	2	1	2
1	6.0	4.4	4.5	4.6	4.9	6.3	3.9	4.8	5.2	5.4
2	5.5	4.0	3.7	4.5	3.9	5.0	5.0	4.0	6.1	5.3
3	5.7	4.1	4.5	5.2	6.6	5.2	4.2	3.5	4.7	4.9
4	6.6	6.1	3.7	3.6	5.3	6.0	2.7	6.0	5.0	3.7
5	5.6	3.7	5.3	2.7	6.4	5.2	4.9	5.7	6.5	6.0
6	5.1	4.8	4.0	4.9	3.5	5.3	2.6	4.5	5.5	4.5
7	6.0	5.4	3.9	5.2	5.9	6.0	5.7	6.3	4.7	4.5
8	5.5	4.6	2.0	4.7	6.3	4.9	4.7	4.2	4.0	3.7
9	5.8	4.3	4.0	4.9	4.7	6.0	3.2	5.0	4.6	3.3
10	5.1	5.5	3.7	5.0	6.2	5.5	3.2	4.9	5.0	5.0
11	4.1	6.3					5.3	3.2	3.3	3.0
12	4.5	3.6					4.3	4.3	3.2	4.0
13	5.1	4.0					6.2	3.7	4.2	5.0
14	5.4	5.0					5.5	4.0	3.5	4.0
15	4.7	5.3					5.9	5.4	2.5	4.3
Average	5.38	4.74	3.93	4.53	5.37	5.54	4.49	4.63	4.53	4.44
Gen. Avge.	5.06		4.23		5.46		4.56		4.49	

Reading Silently

1	6.0	4.0	3.9	5.0	6.1	6.3	2.5	4.8	5.4	4.3
2	5.4	4.0	4.0	5.3	4.0	6.2	4.8	4.2	5.7	4.0
3	6.0	3.7	4.0	4.7	6.5	6.6	6.0	4.0	4.7	4.3
4	5.0	5.5	3.4	4.5	4.9	5.0	2.3	6.8	5.0	3.3
5	3.7	3.7	4.2	2.7	6.6	5.2	4.5	5.7	5.9	4.7
6	4.3	4.9	3.9	4.7	4.5	4.7	3.5	4.7	5.0	3.6
7	5.7	5.3	4.7	4.3	6.0	5.7	5.5	5.3	4.5	3.0
8	5.8	4.5	2.5	4.6	6.5	4.9	4.7	5.7	5.4	2.7
9	5.3	4.0	4.5	5.0	5.7	5.3	4.4	5.0	4.7	4.0
10	4.6	5.7	4.2	6.0	5.8	5.4	4.0	5.0	4.0	4.3
11	4.4	5.5					5.0	4.3	3.6	2.5
12	4.0	4.5					5.3	4.0	4.3	3.0
13	4.7	4.0					5.8	3.5	4.7	6.0
14	4.8	3.7					6.2	3.7	3.4	3.3
15	5.7	5.7					6.0	4.7	1.6	2.7
Average	5.02	4.58	3.93	4.68	5.66	5.47	4.70	4.76	4.52	3.71
Gen. Avge.	4.80		4.31		5.57		4.73		4.12	

TABLE III.

The Reading Value

READING ALOUD

No. of Observer	College		High School		Grades 7 and 8		Grades 5 and 6		Grades 3 and 4	
	1	2	1	2	1	2	1	2	1	2
1	51.0	31.0	26.3	21.7	53.0	40.2	17.0	33.1	35.6	25.8
2	40.0	23.0	20.0	26.0	24.7	33.3	29.3	21.7	34.9	27.3
3	46.0	25.0	28.0	27.0	42.4	19.0	24.6	23.3	27.3	21.3
4	42.0	43.0	21.4	18.4	31.7	25.7	15.5	37.0	19.5	22.4
5	36.0	21.0	31.2	15.8	32.1	34.2	31.0	33.2	39.8	30.7
6	33.0	32.0	24.7	36.4	29.3	31.5	15.5	23.0	30.3	15.8
7	41.0	33.0	23.7	29.0	24.4	31.4	36.3	26.5	31.4	11.5
8	31.0	28.0	10.4	23.2	33.0	36.7	30.0	28.0	25.5	19.2
9	41.0	25.0	19.0	22.7	40.6	39.0	18.0	23.2	29.5	17.0
10	40.0	40.0	18.6	29.4	37.1	33.5	17.6	27.9	23.1	21.8
11	33.0	47.0					33.3	24.5	24.4	11.0
12	26.0	24.0					18.5	13.0	21.9	24.0
13	26.0	25.5					48.7	19.0	26.6	17.6
14	34.0	29.0					39.0	20.2	14.2	14.6
15	32.0	26.0					35.5	22.0	9.0	23.1
Average	36.8	30.2	22.3	25.0	34.8	32.5	27.3	25.4	26.2	20.2
Gen. Avge.	33.5		23.6		33.6		26.2		23.2	

READING SILENTLY

1	52.2	40.0	19.0	26.0	55.7	43.2	11.0	32.4	41.7	20.0
2	41.0	30.0	19.6	23.3	24.5	26.4	40.0	20.7	42.6	15.5
3	45.0	27.0	30.4	31.7	43.4	23.0	33.4	17.0	30.4	18.2
4	40.0	54.0	21.0	32.0	36.2	19.1	13.3	40.1	18.4	22.0
5	29.0	29.0	21.7	16.0	35.3	33.3	24.0	40.4	35.7	36.1
6	26.0	59.0	24.5	37.3	28.2	27.1	18.0	20.7	46.9	15.1
7	41.0	40.0	35.0	29.0	24.3	21.8	36.0	28.0	28.8	12.1
8	40.0	37.0	17.2	25.0	38.6	29.0	31.6	22.7	39.9	14.0
9	50.0	30.0	18.7	25.0	50.5	38.5	18.5	22.0	37.0	18.0
10	43.0	57.0	23.1	28.3	47.7	38.7	20.6	37.6	21.8	15.3
11	40.0	54.0					21.8	20.0	25.4	8.1
12	21.0	38.0					22.5	13.0	28.6	18.1
13	22.0	30.0					54.0	17.7	25.8	16.1
14	34.0	31.0					52.0	21.4	13.8	13.6
15	41.5	30.0					35.0	23.7	6.0	10.1
Average	37.7	39.1	23.0	27.3	38.4	30.0	28.8	25.2	29.5	16.8
Gen. Avge.	38.4		25.2		34.2		27.0		23.2	

thirty college students did better reading aloud while twenty-two did better reading silently. Eight high school pupils did better reading aloud and eleven reading silently. Ten of the 7–8 grade pupils did better reading aloud and ten reading silently. Fourteen of the 5–6 grade pupils did better reading aloud and fifteen reading silently. Nineteen of the 3–4 grade pupils did better reading aloud and eleven reading silently. These values expressed in per cent. of the total number in each group are as follows:

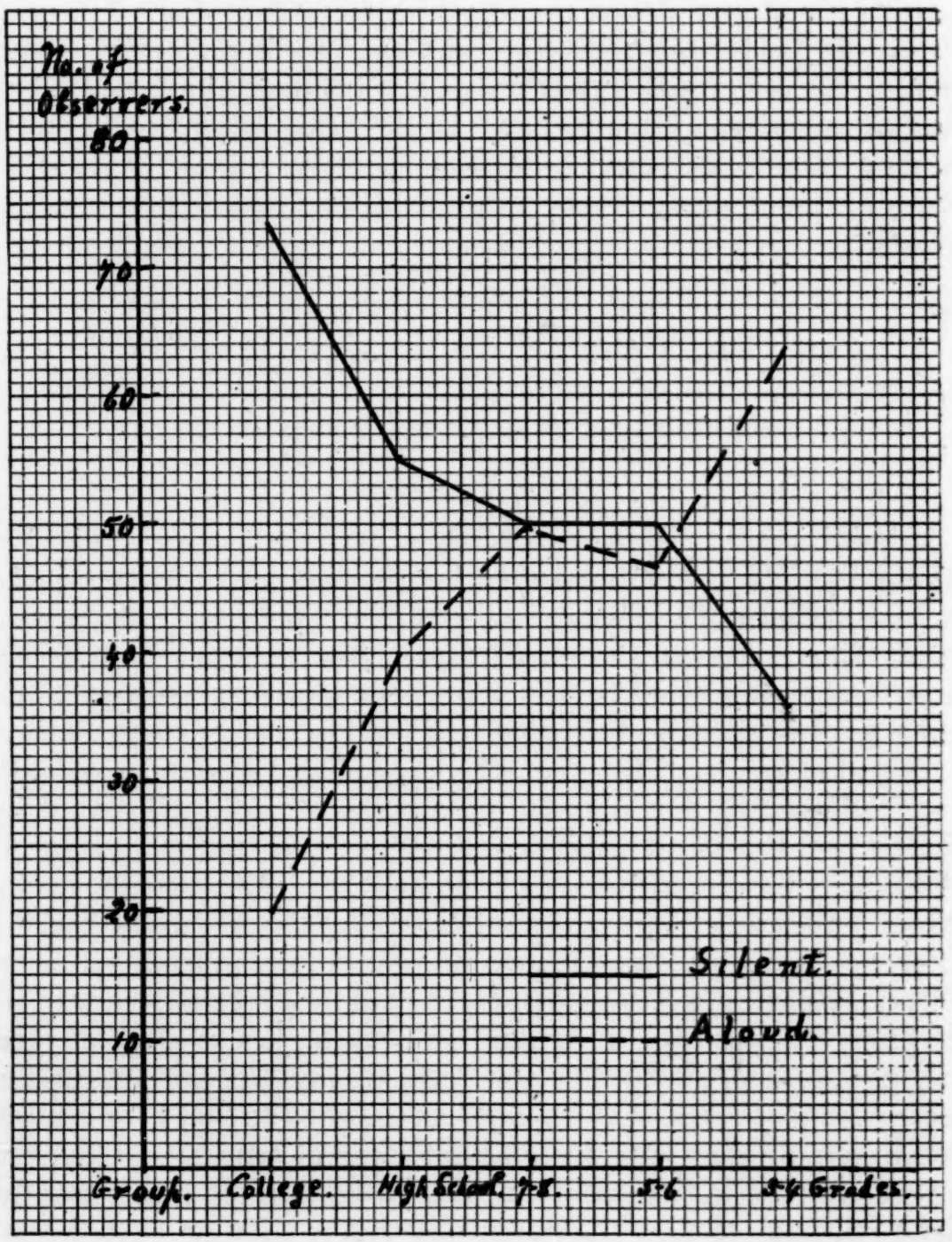
	College	H. S.	7–8	5–6	3–4
Aloud	20.0	40.0	50.0	46.6	63.3
Silent	73.3	55.0	50.0	50.0	36.6

This is shown graphically on the following curve.

Long Passages

In addition to the above results experiments were made with fifty university students reading longer passages. Two passages each containing 43 ideas and about 200 words each were used. In all other respects the conditions of the experiment were the same as before. Half of the observers read one passage aloud and the other silently, the other half read in the opposite method.

The average time for the fifty observers for reading silently was 52.6 seconds and for reading aloud was 65.4, being a saving of 12.8 sec. for silent reading. Reading silently, an average of 14.5 points was reproduced as compared with 13.8 points reading aloud. Here again as with the shorter passages we see no marked difference between the number of points reproduced by either method. Combining the time and the amount reproduced into the reading value for each individual and taking the average of these reading values for all the fifty observers, we find the average reading value for silent reading to be 29.07 as opposed to 21.91 for reading aloud, being a gain of 7.16 in favor of silent reading. Counting the number of individuals who had a higher reading value for silent reading we find thirty-six out of the fifty or 72 per cent. better at silent reading. It was also noted as before that the few who did better in reading aloud showed only a slight advantage over the silent reading. This can be expressed numerically by the difference between the reading values of each individual. The total difference in favor of silent reading for the thirty-six



Graph showing the percentage of observers in each group who did better in reading silently or in reading aloud.

observers is 427.1 or an average of 11.9 whereas for the thirteen who did better aloud (one did exactly the same by both methods) we have a total difference in favor of oral reading of 69.3 or an average of 5.3. This again shows that those who did better in reading aloud surpassed their silent reading much less than those who did better silently surpassed their reading aloud.

Conclusions

It does not seem to make much difference whether a child in the third grade reads aloud or silently. He gets about the same number of ideas per second either way. As we progress through the grades and up into college we find that it takes comparatively longer and longer for reading aloud and this increased time may result in an increase in the number of ideas reproduced. But this number of ideas gained is not nearly commensurate with the extra time expended. The silent reading of the adult is quicker than the oral reading and at the same time the number of ideas remembered is slightly greater, certainly much greater per unit of time. Thus it would appear that silent reading is undoubtedly the more economical besides being the method best adapted to the ordinary activities of life, since the vast majority of our reading is silent. This being the case we are forced to raise the pedagogical question and ask, why it is that so much more attention is given to oral reading than to silent reading in our schools.

We do not propose that the child should first be taught to read silently. It is probably necessary to teach him to read orally first. In learning any new activity the child cannot at first execute it without a great many superfluous movements. Everything tends to express itself in movement in his mental life. But as the learning process goes on he tends to eliminate superfluous movements in his motor responses and also in his responses more intimately connected with his mental life. All this is only the ordinary history of the development of all our exact physical and mental acts, a gradual elimination of all unnecessary processes.

The child in his early learning processes invariably expresses his ideas and meanings in words and movements. But soon the child is able to think without expressing his thoughts verbally. Many of the muscular concomitants of the thoughts are sup-

pressed. This same thing is probably true in the reading processes, one of the great ways by which the child gets new thoughts and ideas. When the child is first learning to read he should give motor expression to his reading. But, as in other life activities, as the process goes on the vocal part should drop out gradually, that is, the child should soon learn to read silently. If he does not, there seems to be great danger in making a fixed habit of too much unnecessary articulation during silent reading, a habit that hinders the rapidity of silent reading afterwards.

As we progress through the grades we see how gradually silent reading surpasses oral reading and yet how often in school teaching do we see the teacher of the fourth, fifth, or even seventh grade emphasizing oral reading in her room, just as if she believed that every one of her children were destined to become elocutionists in later life. Again it has struck us that children in the fifth, sixth, and seventh grades often read aloud worse than children in still lower grades. So many of them hate to stand up and read and when they do so they slur their words as if the oral reading were too slow for them. And this may really be the case as our results would suggest, whereas in still lower grades the child cannot get the meaning faster than his oral reading and therefore he reads better orally.

We feel strongly that the advantage in silent reading would have been greater and would have shown itself much earlier in the grades, if it had not been for the strong influence of early training in oral reading to which most of our children are needlessly subjected. Silent reading should be taught much more and much earlier in our schools.

A SCALE FOR MEASURING ABILITY IN ARITHMETIC

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Nature of the Scale. The scale is designed to measure ability in arithmetical reasoning such as is involved in the solution of concrete problems. It is composed of a series of problems arranged in the order of steps of increasing difficulty. The steps are numbered from one to fifteen. There is one problem to each step with the exception of steps 2, 3, and 5 for which no problems of appropriate difficulty have been found.

The value of the problems was determined experimentally by a test made upon 2515 pupils in grades four to eight inclusive in twenty schools in five states: Maine, Wisconsin, Minnesota, Montana, and Washington.

In using the scale, the pupils are allowed as much time as they need to do as many problems as they can. Practically all pupils are able to finish in twenty to thirty minutes.

Scoring the Results. The score of a given pupil is the number of the highest step done correctly. If a pupil passes all steps up to and including the eighth and fails on all beyond eight his score is eight. If he fails on nine, does ten, and then fails on the rest, his score is nine. That is, he is credited with each additional step passed beyond where he first failed. The actual values of the problems in the scale are indicated in parentheses and do not coincide exactly with the step numbers. For ordinary purposes of scoring, however, they may be regarded as being identical with the various steps under which they are placed.

Arithmetical Scale A[1]

The numbers in parentheses are the actual scale values of the problems.

Solve the following problems in the order given. Do all the work on the back of this sheet.

Step 1. (.4) Mary had 4 apples and her mother gave her 7 more. How many apples did Mary then have? Answer.

Step 4. (3.8) Sam had 12 marbles. He found 3 more and then gave 6 to George. How many did Sam have left? Answer.

Step 6. (5.9) John sold 4 Saturday Evening Posts at 5 cents each. He kept

[1]Copies of this scale for testing schools may be obtained from the writer.

½ the money and with the other ½ he bought Sunday papers at 2 cents each. How many did he buy? Answer.

Step 7. (6.7) If you buy 2 tablets at 7 cents each and a book for 65 cents, how much change should you receive from a two-dollar bill? Answer.

Step 8. (7.7) How many pencils can you buy for 50 cents at the rate of 2 for 5 cents?

Step 9. (9.2) A farmer who had already sold 1897 barrels of apples from his orchard hired 59 boys to pick the apples left on his trees. Each boy picked 24 barrels of apples. What was the total number of barrels the farmer got from his orchard that year? Answer.

Step 10. (10.3) A news dealer bought some magazines for $1. He sold them for $1.20, gaining 5 cents on each magazine. How many magazines were there? Answer.

Step 11. (11.3) In the schools of a certain city there are 2,200 pupils; ½ are in the primary grades, ¼ in the grammar grades, ⅛ in the high school and the rest in the night school. How many pupils are there in the night school? Answer.

Step 12. (11.7) If 3 and ½ tons of coal cost $21, what will 5 and ½ tons cost? Answer.

Step 13. (12.9) A school in a certain city used 2516 pieces of chalk in 37 school days. Three new rooms were opened, each room holding 50 children, and the school was then found to use 84 sticks of chalk per day. How many more sticks of chalk were used per day than at first? Answer.

Step 14. (14.2) A girl spent ⅛ of her money for car fare, and three times as much for clothes. Half of what she had left was 80 cents. How much money did she have at first? Answer.

Step 15. (15.1) John had $1.20 Monday. He earned 30 cents each day on Tuesday, Wednesday, Thursday and Friday. Saturday morning he spent one-third of what he had earned in the four days. Saturday afternoon his father gave John half as much as John then had. How much did his father give John? Answer.

An ideal scale would be one in which a pupil would pass all steps up to a certain point and then fail on all steps beyond that point. We could then say that a pupil's ability in arithmetic is eight on this particular scale just as we can say that a pupil's height is four feet and ten inches. About one pupil in five, however, will break down at some point in the scale and then do one or more steps beyond that point. The method suggested here for scoring such records seems simple and fair. It gives a pupil credit for every step passed and at the same time penalizes him for every step missed.

Standards of Attainment. The following standard scores have been derived from the 2515 pupils mentioned in a preceding paragraph.

Grades	3	4	5	6	7	8
June scores	4.6	6.2	7.8	9.4	11.0	12.6

Individual Differences and the Overlapping of Grades. The facts relative to the range of individual differences and the resulting overlapping of the pupils in the various grades are practically identical with those found for other subjects in which objective measurements have been made. The actual facts

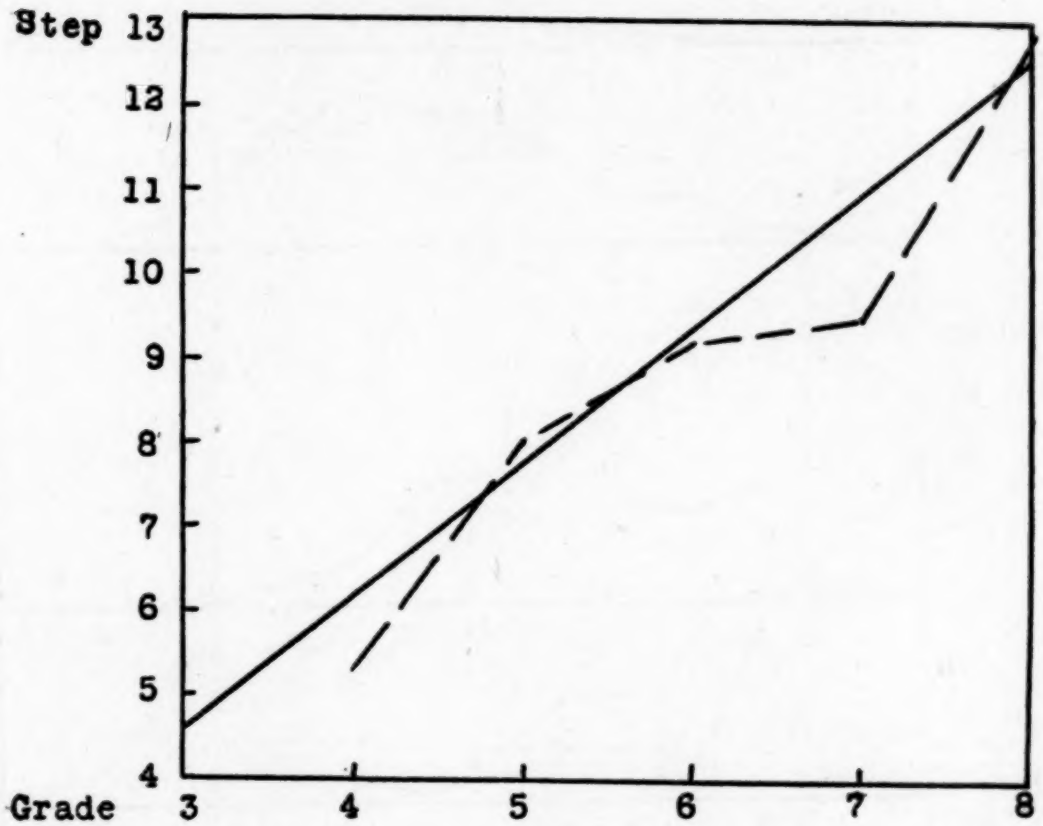

Figure 1. The continuous line is the standard curve. The broken like represents a school in a certain large city. The 7th grade is quite backward and is practically no better than the 6th grade.

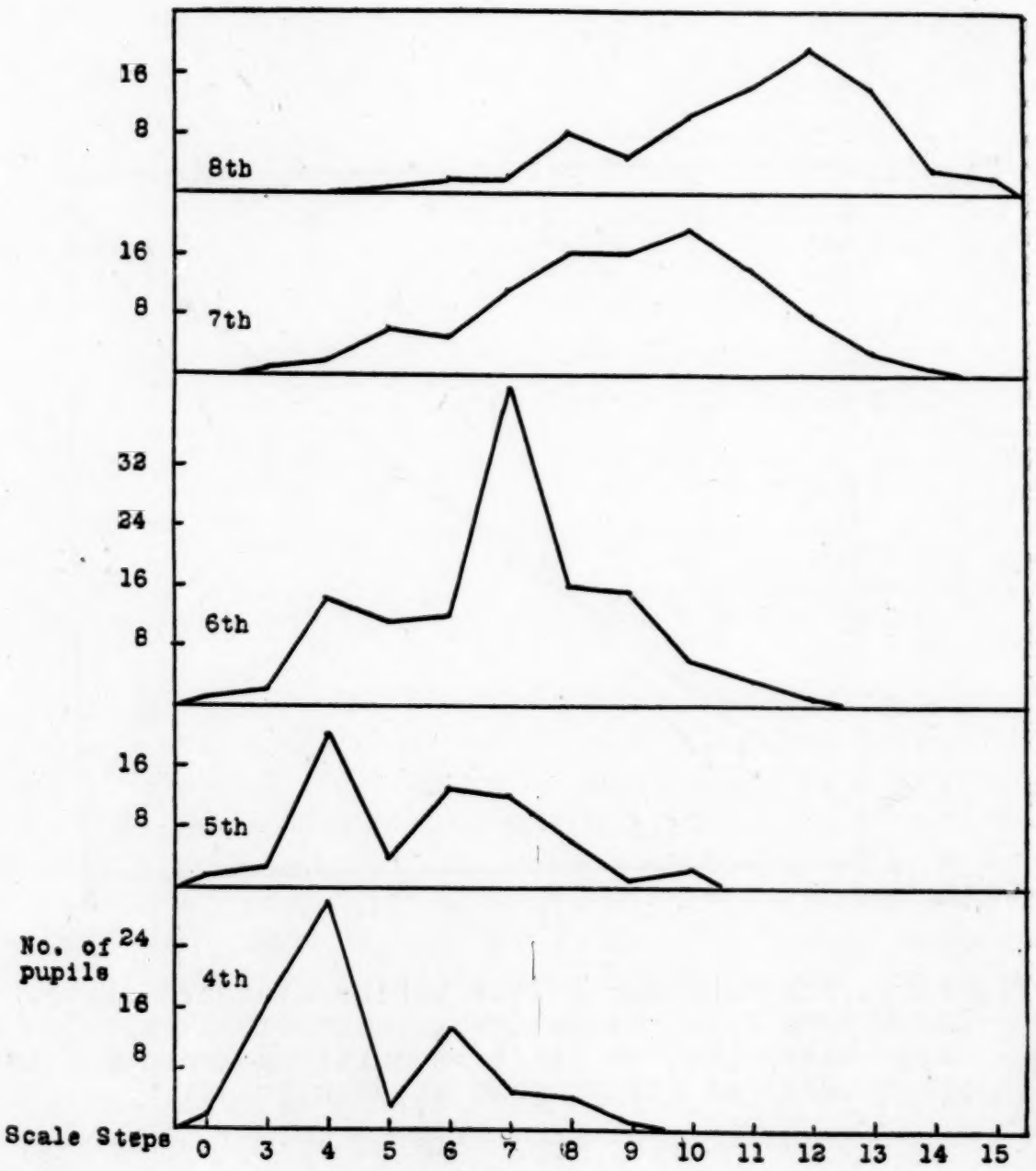

Figure 2. Distribution graphs of 429 pupils in two schools, showing the extent of the overlapping of the abilities of the pupils in successive grades.

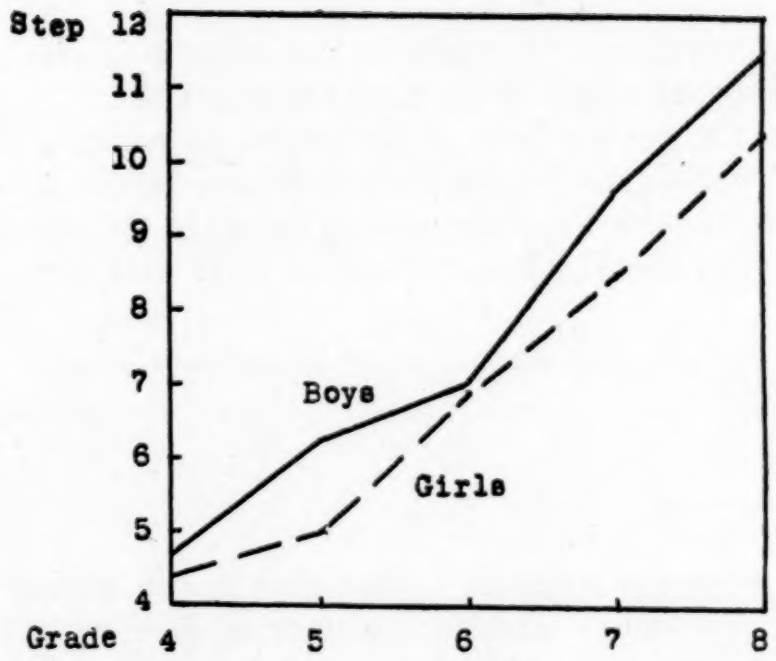

Figure 3. Sex differences. The continuous line represents the boys and the broken line represents the girls in two schools with a total of 429 pupils.

are shown in Figure 2. The graphs are drawn with reference to the same base line so that direct comparisons as to the range of ability and the amount of overlapping may be made. An inspection of the graphs shows an enormously wide range of ability and reveals the fact that the pupils in any given grade are distributed almost over the entire scale. In the sixth grade, for example, they range all the way from step 0 to step 12. The facts are expressed in numerical terms as follows:

In the	4th	grade	33%	of	the	pupils	reach	or	exceed	the	median	of	grade	5	
"	"	5th	"	33%	"	"	"	"	"	"	"	"	"	"	6
"	"	6th	"	22%	"	"	"	"	"	"	"	"	"	"	7
"	"	7th	"	12%	"	"	"	"	"	"	"	"	"	"	8

Corresponding percentages of pupils in the various grades fall down to or below the medians of the next lower grades.

Sex Differences. A comparison of the sexes shows that the boys are superior to the girls by amounts indicated in the curves of Figure 3. If we express the difference in terms of the amount of overlapping of the distribution curves for boys and girls we find that

In the	4th	grade	50%	of	the	boys	reach	or	exceed	the	median	of	the	girls	
"	"	5th	"	76%	"	"	"	"	"	"	"	"	"	"	"
"	"	6th	"	50%	"	"	"	"	"	"	"	"	"	"	"
"	"	7th	"	71%	"	"	"	"	"	"	"	"	"	"	"
"	"	8th	"	55%	"	"	"	"	"	"	"	"	"	"	"
Average				60%											

Apparently the boys are superior to the girls in the ability to solve arithmetical problems. This fact is striking in view of the earlier finding that the girls are either equal to or superior to the boys in speed and comprehension of reading, in speed and quality of writing, and in ability to spell.

Derivation of the Scale. A series of thirteen problems composed partly of originals and partly of some used by Courtis, Stone, and Thorndike, was arranged roughly in the order of difficulty by a brief preliminary test. These problems were then used with the 2515 pupils in the twenty schools mentioned previously. The results were tabulated to show the percentage of pupils in each grade who had done each of the problems correctly. These results are given in Table 1 in the upper horizontal row for each problem. One of the thirteen problems is omitted from Table 1 because it was found to be almost identical in difficulty with problem six. The scale values of the problems were then computed from the data in Table 1 according to the following plan.

TABLE I.

		The percentage of times (upper figure) each problem was done correctly in each grade and its P.E. value (lower figure) with reference to $M_6 = 0$.					Average P.E. Value	Required P.E. Value	Actual scale Value
Grades		4	5	6	7	8			
Problem	1	94.1 —4.20	96.9 —3.43	97.6 —2.95	98.7 —2.45	100.	—3.26	—3.00	.4
"	4	67.7 —2.58	86.5 —2.29	88.1 —1.75	96.4 —1.82	95.8 —1.00	—1.89	—1.80	3.8
"	6	27.7 —1.02	61.0 —1.08	79.7 —1.22	89.0 —.98	92.8 —.60	—.98	—1.00	5.9
"	7	20.1 —.65	51.9 —.74	60.1 —.38	80.6 —.45	88.9 —.25	—.49	—.60	6.7
"	8	16.9 —.47	39.9 —.27	52.8 —.10	78.3 —.35	90.8 —.41	—.32	—.20	7.7
"	9	1.8	24.8 +.44	49.1 +.04	65.5 +.26	78.7 +.40	+.29	+.20	9.2
"	10	2.7 +.96	20.0 +.59	34.6 +.58	52.9 +.74	71.5 +.73	+.72	+.60	10.3
"	11	1.1	9.3 +1.31	24.8 +1.00	41.8 +1.17	63.4 +1.05	+1.13	+1.00	11.3
"	12	.00	4.5 +1.84	18.8 +1.32	47.5 +.93	66.4 +.94	+1.26	+1.40	11.7
"	13	.10 +2.70	4.2 +1.89	15.4 +1.51	39.5 +1.24	58.5 +1.24	+1.72	+1.80	12.9
"	14	.5 +1.91	1.1 +2.74	3.5 +2.70	19.3 +2.13	38.9 +2.00	+2.29	+2.20	14.2
"	15	.00	1.5 +2.56	2.9 +2.80	10.7 +2.70	26.2 +2.51	+2.64	+2.60	15.1

On the assumption that arithmetical ability is distributed according to the probability curve, we are able to compute the scale value of each problem for each grade from the percentages of Table 1. These values will be expressed in terms of the probable error and the value of the probable error will be taken as 1.00. Thus in the 6th grade, problem 1 is gotten right by 97.6% of the pupils. Let us consider the median of the 6th grade as 0 and all distances to the left as minus values and all distances to the right as plus values. Now turning to a table

of P. E. values,[2] we find that the point which includes 97.6% of the cases of the distribution curve lies 2.95 P.E. out from the median, and since it is gotten right by more than 50% of the pupils its value lies to the left of the median and hence is —2.95 P.E. Similarly the value of each problem in each grade may be expressed in terms of P.E. values.

In order, however, to make the values for one grade comparable with those of other grades, it is necessary to determine the distances between the medians of the various grades. For example, it is necessary to know how far the 7th grade median (M_7) is to the right of the 6th grade median (M_6), and how far M_8 is to the right of M_7. Likewise it is necessary to know how far M_5 and M_4 are to the left of M_6.

The distances between the medians of the various grades were determined from the values of the problems in Table 1 as follows: The P.E. value of problem 1 in the 6th grade is —2.95, in the 5th grade it is —2.77. Hence so far as this problem is concerned M_5 is as much to the left of M_6 as the difference between the P.E. values of this problem in the two grades indicates, or .18 P.E. The P.E. value of problem 4 in the 6th grade is —1.75 and in the 5th grade —1.65. Hence for problem 4, M_5 is .10 P.E. to the left of M_6. In this manner the distance between M_5 and M_6 was determined for each problem. The average of these differences was taken as the actual difference between the medians of these two grades. By exactly the same computation the differences between the medians of the other grades were determined in terms of P.E. These were found to be as follows:

$$M_8 - M_7 = .72 \text{ P.E.}$$
$$M_7 - M_6 = .85 \text{ P.E.}$$
$$M_6 - M_5 = .66 \text{ P.E.}$$
$$M_5 - M_4 = 1.24 \text{ P.E.}$$

Hence, if we take M_6 as the point of reference and call it 0, the positions of the medians of the various grades will be as follows:

$M_4 = (M_6 - M_5) + (M_5 - M_4) = -.66 \text{ P.E.} + (-1.24 \text{ P.E.}) = -1.90 \text{ P.E.}$
$M_5 = -.66 \text{ P.E.}$
$M_6 = .00 \text{ P.E.}$
$M_7 = .85 \text{ P.E.}$
$M_8 = (M_7 - M_6) + (M_8 - M_7) = .85 \text{ P.E.} + .72 \text{ P.E.} = 1.57 \text{ P.E.}$

[2] THORNDIKE, E. L. *An Introduction to the Theory of Mental and Social Measurements.* (1913) p. 200.

From these values we are now able to compute the P.E. value of each problem in each grade with reference to M_6, which equals 0, as follows:

The P.E. value of problem 1 in the 6th grade is —2.95. The P.E. value of problem 1 in the 5th grade is —2.77 with reference to M_5, but M_5 is —.66 P.E. to the left of M_6. Hence the value of problem 1 in the 5th grade is —2.77 + (—.66) or —3.43 with reference to M_6. Likewise the value of problem 1 in the 4th grade is —2.32 with reference to M_4 but M_4 is —1.90 P.E. to the left of M_6. Hence the value of problem 1 in the 4th grade is —2.32 + (—1.90) or —4.20 P.E. with reference to M_6. In the 7th grade the value of problem 1 is —3.30 with reference to M_7 but M_7 is + .85 P.E. to the right of M_6. Hence the value of problem 1 in the 7th grade is —3.30 + .85 or —2.45 with reference to M_6. Since problem 1 is gotten right by 100% in the 8th grade, its value can not be determined in the 8th grade. The average P.E. value of problem 1 in grades 4 to 7, which is —3.26 P.E., will be taken as its actual value.

In a similar manner the P.E. values of all problems have been computed and are given in Table 1, the second horizontal row for each problem. The average P.E. value of each problem is its scale value. A distance of .40 P.E. has been chosen arbitrarily as the distance between the steps of the proposed scale. This particular distance was selected because the actual P.E. values of the problems conform most closely to steps separated by this amount. Table 1 gives in the columns on the right the actual P.E. values of the problems, the required values for the various steps, and the actual values of the problems expressed in terms of the proposed steps.

It remains to point out the difference in method and principle employed here for determining the location of the grade medians with reference to one another, and the method employed by Buckingham in his work on spelling.[3] Buckingham determined the distances between the grade medians by considering the words as of equal value, by constructing a distribution curve for each grade, and by ascertaining then the amounts of overlapping of the curves of the various grades. This method involves two serious errors. The first is that of regarding all

[3] BUCKINGHAM, B. R. *Spelling Ability*. Teachers College, Columbia University.

words as of equal spelling difficulty, the very point which the investigation attempted to ascertain and disprove. The second is that the words employed were far too easy for the upper grades which produced a contraction of the distribution curves at the base line which in turn produced an apparently greater distance between the grade medians than actually existed. The final scaling of the spelling words is distinctly affected by these two factors and thus made uncertain. The grade medians can be computed for the spelling test in the same manner as that employed for the arithmetical problems. By doing this it will be found that the distances between the grade medians will be considerably less than that found by Buckingham. The method employed here avoids the effect of the two factors mentioned above and assumes only that each problem has its own fixed value along a linear scale, and that the actual distances between the grade medians may be directly determined from the value which each problem has in each grade.

COMMUNICATIONS AND DISCUSSIONS

THE COLLEGE FRESHMAN AND MATHEMATICS

The college freshman, under the present system, is everywhere a variable quantity. But the professor of mathematics is face to face with a demand for a proper development in mathematical skill during the year, for the development of the ability to do accurately and quickly certain definite things in practical life, for a course that will give to the student a maximum efficiency. It is not sufficient that the individual be courteous, loyal, appreciative;—he must be more than this, he must be efficient in his work. This requires that he comprehend the problem more definitely, that he perform with greater celerity and perceive with greater accuracy. Yet what is the standard of efficiency that the professor has a right to expect at the beginning of the year, and at the end of the year? What is the growth in efficiency that the pupil has a right to expect? What course will best meet these requirements?

It has been with an idea of answering these questions, partly at least, that I have undertaken to test the mathematical efficiency of certain college freshmen which have come under my instruction during the past two years, and as far as possible to test their growth in mathematical efficiency when different tests are used, or the subject matter presented in different ways.

The experiment was begun with the freshmen in the fall of 1914, the course being required of all freshmen, and the sections formed entirely at random. The section meeting at 8:00 o'clock used Brenke's Advanced Algebra and Trigonometry for six months and Nicol's Analytic Geometry for the remainder of the year. The section meeting at 1:30 o'clock used Hawk's Advanced Algebra, Granville's Trigonometry, and Smith and Gale's Analytic Geometry. In each section approximately three months time was given to each subject, namely, algebra, plane trigonometry and analytic geometry, and care was taken to cover substantially the same topics and give to each topic approximately the same amount of time. During the nine months, seven tests in fundamental operations in arithmetic, algebra and trigonometry were used, some of which have been satisfactory, others have not.

In this paper the writer will give and attempt to discuss the results from two tests on fundamental operations, namely: the "Courtis Standard Tests in Arithmetic," Series B and Series A, form 3. The first test, which included twenty-four problems in each of the following: addition, subtraction, multiplication and division, was given to 93 pupils in the 7th, 8th, 9th and 10th grades in the Fairfield Public Schools and to 39 freshmen in Parsons College on October 14th, 1914, and to two sections of freshmen of 29 students each on October 6th, 1915. On November 25th, 1915, these same tests were given to twelve sophomores taking calculus. The tests were given to the grade pupils and the results computed by Miss Ruth Sumner. The other tests were given by the writer, and the tabulated results showing the average for each section are given below. Of the two sections for 1915, the record of the 8:00 section will be given first. The column indicating the number attempted in each operation is marked *att.* and the column indicating the number correct is marked *rt.*

Grade	Addition		Subtraction		Multiplication		Division	
	att.	rt.	att.	rt.	att.	rt.	att.	rt.
7th	8	5	9	7	8	5	9	6
8th	11	7	13	10	11	8	13	9
9th	9	7	12	10	11	7	11	10
10th	6	5	9	7	9	8	9	8
Freshmen								
1914	13.4	11.1	18.3	13	15.1	10.8	13.7	10
1915:8:00	12.2	9	15.4	12.4	13.2	10.	12.3	11.2
1915:2:25	10.4	7.7	16.	12.8	12.7	9.4	12.9	11.3
Sophomores								
1914	12.8	10	17.	14	14.6	11	14.5	14
1915	13	9.7	18.6	15	16	11	16.1	15

In these tests it will be seen that the 8th grade shows a decided gain in efficiency over the 7th grade, while the first year high school pupil was not more efficient in fundamentals than the 8th grade, and the 10th grade taking geometry has a decidedly lower standard. The results of the same test given to these pupils three months later indicated the same relative efficiency.

The freshman standard is decidedly higher than that of the grades and the sophomores show a substantial gain over the freshmen, and an average gain of about ten per cent. over their own record as freshmen. The individual variation in efficiency in the different sections was truly astonishing. Below is added what is in the judgment of

the writer the most efficient and also least efficient record made in each operation in each section. In each instance seventeen attempts with fourteen right is considered more efficient than twenty-one attempts with twelve right.

Section	Addition		Subtraction		Multiplication		Division	
Freshmen	att.	rt.	att.	rt.	att.	rt.	att.	rt.
1914 Highest..	24	22	24	22	24	22	24	24
Lowest...	11	0	9	3	8	3	9	3
1915 Highest..	24	24	24	24	23	20	24	22
Lowest...	6	3	13	5	7	4	8	7
1915 Highest..	22	16	22	20	23	17	20	20
Lowest...	6	2	9	3	7	4	6	3
Sophomores								
1915 Highest..	16	14	24	23	16	16	21	19
Lowest...	7	4	10	7	9	4	7	6

The above data do not show the extreme variation in every instance, as some of the most efficient completed the test in three-fourths of the time allowed. Yet each pupil whose grade is recorded above is a graduate of a fully accredited high school or academy and the present policy requires them to be taught in the same class. The record of the sophomore class for 1915 is quite uniform with one exception. One student always works very slowly, but thinks well, and is an acceptable student in calculus.

The second test, series A, form 3, included 8 tests, viz.: No. 1, addition; No. 2, subtraction; No. 3, multiplication, No. 4, division; No. 5, copying figures; No. 6, easy reasoning; No. 7, fundamentals; No. 8, more difficult reasoning. This test was given in each instance about six weeks after the test, Series B. It was given to the freshmen only and the tabulated results, showing the average number for each section, are given below:

Class	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6.		No. 7		No. 8	
						att.	rt.	att.	rt.	att.	rt.
1914	71	62.3	53	57.8	118.5	8.2	8	16	10	5.6	4.2
1915	69	55	56	57	115	8	7.5	16	11	5.5	4
1915	72	58.5	56	57	117	7.5	7	15.7	10	5.4	4.2

The uniformity of the average record of the three sections is quite striking. Yet the individual variation was very great. What is considered by the writer the most efficient and also the least efficient record in each operation is given below.

Class	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6		No. 7		No. 8	
						att.	rt.	att.	rt.	att.	rt.
1914	100	85	69	77	150	12	12	19	17	8	7
	41	42	31	29	93	4	4	14	4	3	2
1915	100	102	75	83	150	11	10	19	18	8	7
	51	40	40	40	82	8	2	13	3.5	2	1
1915	112	78	70	82	150	10	10	19	18	7	7
	40	32	37	35	80	4	1	9	3	2	0

It will be seen from the above data that the efficiency of the lowest record in terms of the highest record will average not over forty per cent.

In 1914 the two sections seemed to have nearly the same efficiency at the beginning of the year but the class (8:00 section) showed an efficiency of only 85% of that of the other section at the end of the year and exactly $\frac{1}{5}$ as many students from this section elected calculus in 1915 as from the other section.

The wide variations in efficiency in fundamental operations continued throughout the year and in general, not always, was indicative of the rank of the students as determined by the semester grade. The two results were, in general, in too close agreement to be mere coincidence.

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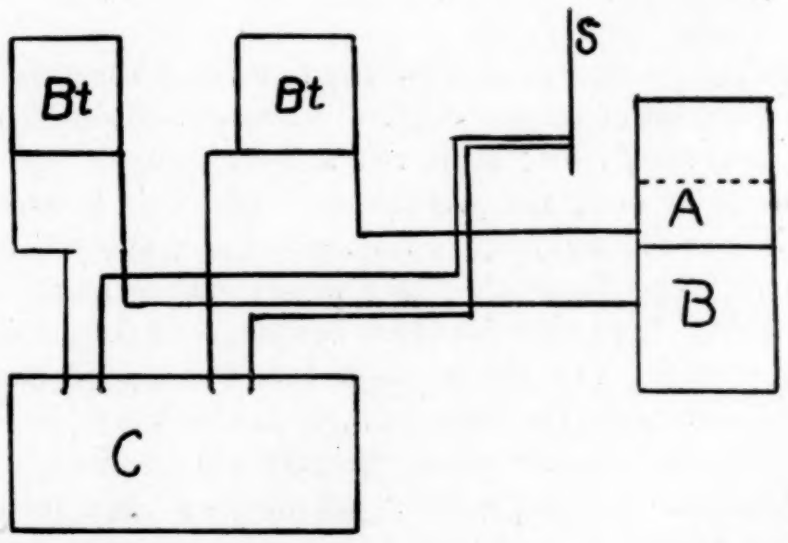
TIMES OF WRITING EACH OF THE ARABIC NUMERALS DETERMINED BY THE REACTION TIME METHOD.

In constructing any arithmetic test in which all possible factors are to be controlled it is important that the time for making the figures to be written by the pupil should be evaluated. We know in a general way that it takes longer to make a "5" than it does to make a "7." If we are to construct examples upon a scientific basis, the relative difference between the times for making the ten Arabic numerals must be known more accurately.

Through the courtesy of Dr. James P. Porter, head of the Department of Psychology of Clark College, the above mentioned determination was made possible by the use of the Bergstrom Pendulum Chronoscope. In determining the times for making the different figures the following method was used:

A steel stylus S (Fig. 1), and two thin pieces of copper, A and B, partially superposed but separated by a sheet of tissue paper were introduced into the circuit with the chronoscope, C. The figures were made upon the surface of the upper piece of copper, A. When the stylus touched this surface the pendulum carrying the indicator of the chronoscope was started. The figure was made in such a way that the end of the last stroke brought the stylus off of the first surface on to the surface of the second piece, B. When the steel point made contact with the second copper surface the indicator of the chronoscope was stopped by its magnet and the time for making the figure could be read in thousandths of a second.

FIGURE I.
Diagram showing Chronoscope with connections used in determining time of writing Arabic numerals.



A and B --Copper plates
S -- Stylus
C -- Chronoscope
Bt -- Batteries

After preliminary trials each figure was made twenty-five times on the first day. In order to corroborate the results of this first day's work, the experiment was repeated on the next day in exactly the same way. The following table gives the results:

TABLE I.

Median Times, Standard Deviations, and Probable Errors in 1000ths of a Second for Writing Each of the Ten Arabic Numerals.

	First Day				Second Day		
Numerals	Median	S. D.	P. E.	Numerals	Median	S. D.	P. E.
1	40.1	3.3	2.23	1	46	2.9	1.96
2*	224.5	8.6	5.8	2*	261	14.7	9.92
2	140.2	5.3	3.57	2	161.5	9	6.07
3	260	13.3	8.97	3	262.5	14.2	9.58
4	241	11.3	7.62	4	236	9.3	6.27
5	295	8.1	5.46	5	298	8.0	5.39
6	172.5	8.0	5.39	6	160	9.2	6.20
7*	259	16.3	10.99	7*	220	12.9	8.70
7	114	7.9	5.33	7	98	9.9	6.68
8	185.3	7.0	4.72	8	210	10.5	7.08
9	170.4	7.0	4.72	9	184	10.7	7.22
0	118	3.9	2.63	0	110.2	6.5	4.38

Although the manner of making the figures by the children in their school work cannot be controlled, it was thought advisable to make the figure "2" and the figure "7" in two different ways. The figure "2" was first made by using the preliminary loop which is sometimes used in the making of the figure. In the second case the preliminary loop was omitted. The figure "7" is also sometimes made with a preliminary stroke. The time for these figures was taken with and without such a stroke. The results show that this added movement increases very materially the time for making the figure.

In these experiments, the writer was the only subject. It is highly desirable that many more subjects of differing ages be used. This brief account is offered in the hope that some suggestions may follow leading to a more scientific construction of test examples to be used with out school children.

ARTHUR W. KALLOM.
Department of Educational Investigation and Measurement,
Boston, Mass.

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*Preliminary stroke is used.

MENTALITY TESTS: A SYMPOSIUM

The suggestion of a symposium on this subject in the last number of the Journal has met with a most generous response. In order to give the discussion a definite impetus, a carbon of the manuscript for the note on this subject in the March number of the JOURNAL was sent to a few of the workers in this field. All of them responded immediately, and two volunteer responses came in addition. These replies are arranged in alphabetical order and must now speak for themselves. It is hoped that we may have reactions to these utterances and further contributions in the same spirit from many others who are entitled to an opinion in this gathering of the clan. All communications on this subject should be sent to the undersigned. As soon as a reasonable amount of material has appeared, some sort of analysis and general inventory of the situation will be made.

The workers in this field crave a sort of heart to heart talk, free from formalities and generous in self-revelation—an exchange of views which may fill the want strongly felt at the last meeting of the Psychological Association after hearing so many formal papers on this subject. It is important that we should think of these utterances as representing merely a fireside chat at a gathering of the leaders in this most promising field of work.

C. E. SEASHORE.

In reply to the suggestions of the Editor I submit a few comments on the present status of mental tests as I see it and upon certain desirable lines of development.

There is in the first place crying need for authoritative expression regarding the actual demonstrable achievements of the "test" movement. Reputable psychologists have, so far as I have observed, sinned but rarely in this particular, but the great rabble of "near psychologists," fake psychologists and their kith and kin, exploiting a newspaper press, always of easy virtue where a sensation or a scoop is in prospect, have poisoned the public mind with expectations which are at present, to say the least, utterly groundless. Already in certain important centers the failure to make good the promises held out has occasioned a vigorous reaction of public opinion which threatens to sweep away before its righteous disgust with the essential fraud perpetuated upon it, all that is at bottom really good and sound and wholesome in the mental test propaganda. Let us have

some frank speaking by our leaders regarding the real facts of the case. Unless this is done and done quickly, we shall have a needless battle on our hands, a battle to prove that the test which we are offering to assist in the solving of many educational and social problems is not in reality the discredited implement which an outraged public has already discarded.

In the second place let us inaugurate a campaign of conservatism in the inferences drawns even from such tests as are well-devised and carefully applied. Let us frankly recognize and clearly state that our enterprise is still in a pioneer condition and even with the best of correlative formulae and the most scientifically computed of distribution graphs, we cannot dogmatize with certainty regarding the meaning of our results. Science as well as art is long, and patience, that un-American virtue, is wholly indispensable.

Let us furthermore for once attempt some genuine scientific co-operation. The author's personal experiences do not make him very optimistic, but surely there is no "a priori" impossibility of distributing through a group of co-operating laboratories the attack upon just such problems of standardization as we are obviously facing in the test situation. Suggestions of the lines along which such co-ordinated effort might profitably proceed are abundantly contained in Professor Yerkes' memorandum and Professor Seashore's commentary thereon.

JAMES R. ANGELL.

University of Chicago.

Here in the Carnegie Institute of Technology and in several other educational institutions the departments of psychology are undertaking to make practical application of the methods of mentality testing. Their interests, however, is not centered in the defective or the abnormal or the child mind, but in the traits and abilities exhibited by students of college age with an intellectual status ranging well above the average of the adult population. Departments of psychology are being called upon to aid college officers (a) in selecting applicants for admission, (b) in classifying students, (c) in helping individual students to discover and remedy their own weaknesses, (d) in advising students in the choice of careers and in the election of studies, and (e) in placing students in the right jobs at graduation. Five years ago such a program would have seemed fatuous; and at the present time much less can be accomplished than certain fervent

believers in mentality testing have led some people to expect. But technique and available norms have been perfected to a point where the worth of mentality testing of college students is already proving itself.

For the successful prosecution of this program there is needed, first of all, a scale for measuring intelligence, with norms obtained from the most able and brilliant adults, as well as from the other ranges of ability.

The supplementary scales proposed by Yerkes and Seashore I should judge to be useful in the following order: first, ideational processes; second, affective processes; third, presentative processes; fourth, motor processes; and least important, receptive processes. But more important than any of these, if it could be made, would be a scale of conative abilities. Webb, in his recent study of "Character and Intelligence," has certainly made out a strong case for the existence of a second general factor in addition to the intellective factor of general ability, a factor which would popularly be designated as "character" and which Webb suggests may take the form of persistence of motive. The scientist who makes a workable scale for measuring persistence of motive will take rank with Binet. The task seems fantastic, but no more fantastic than did the proposal in 1905 to have a graded scale of intelligence.

The most promising field for the immediate future I conceive to be in standardizing intelligence tests for adults. Our own program includes the preparation of percentile charts showing distribution of abilities in several traits, using for the most part tests and procedures already described. At the present moment we are particularly concerned with group tests which can be given to large numbers at once, to be used for rough preliminary mentality examinations. Next year the newly founded Bureau of Salesmanship Research will undertake to utilize these and other more elaborate tests in measuring the traits essential for success in high class salesmanship.

W. V. BINGHAM.

Carnegie Institute of Technology,
Pittsburgh, Pa.

(Extracts from a personal letter to C. E. S.)

I am now reading proof of a translation of practically everything that Binet wrote on the subject of measuring intelligence. We hope to have this on the market in May. I think this will be my contribution to the discussion.

Your symposium sounds like a good thing and undoubtedly it will be interesting reading, but I really do not look for any great unanimity until more people get down to solid work on the problem.

It seems to me that there are two ways of attacking a problem like this. One is to begin at the beginning and put one's self through a complete evolution of thought in the matter, making all the trials and errors necessary before one arrives at the final truth. The other method is to make as complete use as possible of all that has gone before, to begin where the pioneers left off. I began by the former method because I was unfortunate enough not to find the great and important work that was being done elsewhere. However, I did find it after a while and since then have been trying to go on where Binet left off. There is no real reason now why anyone else should follow the first method unless he chooses to do so, and yet, as I see it, most students of the problem of measuring intelligence are doing just that. We shall find eventually that they will all come out to the point where Binet left the matter and then if they live they will be able to go on further. It seems to me it is rather a pity that more who are interested in the matter do not take the other course and profit by all of Binet's work and go on where he left off. Terman and Kuhlmann seem to be doing this. I, myself, as you know, am not working on the testing of intelligence but am studying the feeble-minded. I use the Binet tests because they are so far the best that have been produced. Just as soon as something better appears I shall certainly use it, but by present methods progress is very slow. There are some other methods available and I am constantly trying to help out where it is necessary by other tests than those of Binet, but Binet is the main reliance with me as it is in actual fact with a large number of those who criticize him most severely. We cannot get away and never will get away from the mental levels as established by Binet. You will perhaps ask, as others have, why I hold so solidly to Binet. I think it is because I had had several years experience with the feeble-minded before I knew of Binet's work in this line, and have had more experience since, and I never cease to marvel at the wonderful insight Binet had and the amazingly accurate results that he obtained. In other words, I have found from nearly ten years living with the feeble-minded that Binet was correct in his theories of the feeble-minded and of their psychology, to a much greater extent than is given to most mortals. When one has been able to check a man up and find him almost universally wise and correct in his theories,

one comes after a while to the point where he does not feel it necessary to question anything that he says unless one has right at hand the facts that contradict him.

HENRY H. GODDARD.

Vineland, N. J.

Regarding the question of age standards. Age standards have to be set up in order to make a test usable for diagnostic purposes either by arranging the tests according to ages, as in the Binet Scale, or by determining standard scores for the various ages in tests or test groups which are not themselves arranged according to age. In the one case the age standard is used directly and is incorporated into the arrangement of the test series; and in the other case it is used indirectly. In the latter case a score must be determined in absolute or percentage (point scale) terms, and then transmuted into terms of age progress by comparing it with the standard absolute or percentage scores by ages.

Absolute or percentage score can be interpreted directly if performance in the test is not affected by age. Otherwise it is obvious that any particular absolute or percentage score would mean one thing for a child of one age and another thing for a child of another age. It would simplify matters then if we could use tests which are relatively little affected by age differences. It is true, as Seashore asserts, that we approach this condition when we examine the elemental capacities, as pitch discrimination, discrimination of two points, scope of attention for simple objects, and probably color discrimination. In such simple traits we appear to be able to approach a measure of individual differences among persons of different age. But the differences we obtain are of the least significance for intelligence, as it appears from the studies of several, among them Seashore himself, Norsworthy, Simpson and Burt, that the simple sensory and motor tests are correlated least with other measures of intelligence. It is in the more complex functions, which develop more with age, that the chief indications of intelligence are to be found. In other words, the capacity for learning, which is responsible for the greater part of progress with age, is closely related to intelligence. An intelligent child differs more at different ages than a stupid one. Hence functions which show marked development with age must be the chief subjects of intelligence tests.

The chief difficulty with the Binet scale, so far as its general form is concerned, is not that it is organized in age groups, but that the score is not analyzable. It lumps together scores on too many different functions, and not the same functions throughout the scale. Others have already proposed the remedy, which is to organize a series of graded tests all of which are to be given to all ages (or all ages within a certain definite period). A score can then be given in each type of mental process, and either by reference to age norms or by virtue of the fact that the score is in terms of age, the child can be given a qualitative rank which expresses his relative strength and weakness. For purposes of general ranking the individual scores can be combined.

To make any scheme usable for diagnostic purposes, the norms will have to be adapted to the particular social and perhaps racial group to which a child belongs. This is just as necessary for the interpretation of a point scale as for any other.

Different degrees of merit in an answer should be taken account of in the score.

A test arranged so as to constitute steps of increasing difficulty, the score to be based on the last step successfully attempted is very convenient when the nature of the task permits this form of organization.

FRANK N. FREEMAN.

University of Chicago.

The avidity with which the Binet-Simon tests have been seized upon and used in many countries, is striking evidence of the need there is for this sort of application of psychology. These tests were devised for a local purpose in Paris, to separate the mental defectives from the normal children in the schools. They have been extended into the examination of every sort of social misfit in hospitals, courts, and correctional institutions, and in the schools.

It is patent to most persons working in this field of applied psychology, that we are waiting only for an improvement in methods of measurement and analysis, in order to make a wonderful extension of this species of psychological measurement into the field of vocational guidance. We all realize that psychology should be the guide of educational practice in the realization of the most desirable socialization of the individual. We also realize that the analysis of the mental equipment of our best endowed children, in order that they may be effectively trained for the highest service, is vastly more

important than the analysis of defectives and delinquents. A better psychology will procure us a better education. Education awaits this extension of psychological measuring methods in order to become, itself, a real science.

Since psychology became an empirical science nearly forty years ago, mental examinations of insane subjects have been made along psychological lines of division of mental processes. Psychiatrists compare the scope and span of attention of their patients with those of normal subjects. Likewise they attempt to measure the association, the reproductive and constructive imagination, the inventive capacity, the judgment, and the self-control, of psychopathic subjects in terms of the same functions as exhibited by normal persons. In the same way the emotional life, the irritability, the distractibility, the influencability, and the steadiness of purpose are compared with the like attributes of non-psychotic subjects. All these endeavors of psychiatrists indicate the eagerness with which they would welcome some really psychological measuring instruments for these various attributes of human nature which they find distorted and perverted in their subjects.

The staunchest champions of the Binet-Simon method acknowledge it to be a rough and inaccurate means of measuring intelligence. It is destined to appear crude and more primitive, as more scientific methods of measuring character development are devised; and such are certain to be forthcoming.

It was the dash of a genius in Binet when he conceived the simple way of measuring intelligence by the years of a child's life. The application of this measuring scale of intelligence has made possible not only comparative statements of degrees of developments of intelligence of feeble minded individuals and of other exceptional children, but it has also opened the way for devising and standardizing measuring instruments for all the mental processes which enter into the structure we call character. We stand at the opening of an era of great progress in the application of psychology in the study of the development of personality. Where we are now measuring the *intelligence* of *aments*, we are soon to provide ourselves with measuring instruments for measuring every kind of mental capacity which enters into the *social efficiency of the individual*. These species of measurement will be seized upon by psychiatry and education.

The year scale is unpsychological. It presents a good plan for distinguishing stages in development of infants and very young children.

In such mental development must be registered in terms of movements and actions. Scraps of information such as right and left, and of what sex he is may well supplement these movements when language has been acquired. But middle childhood cannot be best measured mentally by those other scraps of information, such as date of birth, day, month, and year at examination, days of weeks, and months of the year. Mere knowledge can not be constituted an index of mental development. The developing mind is a developing set of capacities to function. We must measure these capacities to function. And the only known way to measure a mental function is in terms of itself; that is, one exhibition of a functional capacity must be stated in terms of some other exhibition of the same.

Yerkes made a definite forward step in the matter of mental measurements when he put the Binet material into the form of a Point Scale. The Point Scale puts this matter into shape for comparative studies of mental capacities of one individual with those of others. It enables one to measure the individual performance in the terms of performances of groups of persons of his age, sex, and social status. It affords a real comparison of mental capacities. The measuring rod of the group is laid upon the individual.

Yerkes' present a m for three different short scales for infants, children, and adolescents and adults, will commend itself to all who have worked with the Yerkes-Bridges Point Scale. Some of the simpler tests constitute a waste of time for adolescents, while for young children many of the higher tests are so difficult as to discourage them. The next step is therefore such a distribution of the material now in hand, as to make these three different short scales, each administrable in thirty minutes or less. This development will not be one of lasting moment in the development of the processes of mental measurement. It will, however, facilitate the making of such measurements as are now possible. It will contribute to the speed and accuracy of such measurement as is now demanded by the exigencies of social life. It will do more than this, however. By facilitating current methods it will aid in accumulating data of value in devising partial scale for measurement of special mental capacities.

Psychology is not prepared to name these functions or capacities of the developing person, or to lay out in logical order the *kinds* of mental process which enter into the composition of character, much less is it able to exhibit the laws of mental growth. This lack in the logic of psychology is however no reason for abstaining from measuring

or from endeavoring to perfect our measuring instruments. Rather is it an incentive to push on to devise more accurate measuring methods. The application of these methods will inevitably advance the science of mental development. Botany does not refrain from physiological theories of the mechanism of plant metabolism, because it does not know precisely where and how the sap flows in trees. Measuring the direction and speed of flow of sap is a process which must precede an accurate physiology of plant life.

The logic of a science must develop as the complement of the accumulating facts of that science. The fundamental matter in all science is accurate observation. For this, measurement is indispensable. As progress is made, therefore, in measuring the phenomena of the growth of mental processes or of mental ability, the principles of the mechanisms of mental growth will emerge into view. The logical order and classification will emerge, as measurement progresses, and we shall see better what to measure.

Meanwhile we have a logic of psychology which we are not applying in our measuring activities. We have done little toward measuring by a Binet or a Yerkes method, the *emotional* and *conative* processes, which are unquestionably of great importance in the growing organism we call *character*. Measuring methods must be devised for these. We must measure mental development from all possible angles. We must devise *assay methods* which will reveal the *composition* of *human character*, at every possible stage of its development.

Because some of the *partial scales* for measuring intelligence promise to lead into regions of developmental psychology not previously touched upon by measurement methods, these and similar lines of research should be pushed with a view to finding tests which will measure the mental attributes and capacities not assayed by existing measuring scales. Such partial scales are Sylvester's standardization of the Sequin Form Board, Pintner's expansion of the Knox Cube test, and Miss Bowler's curtailment of Trabue's Completion test. Much promise lies also in Miss Bowler's pursuit of Decroly's Picture Story Arrangement, and in Pintner's standardization work with a variety of form boards and other performance tests.

THOMAS H. HAINES, M.D.
Clinical Director, Bureau of Juvenile Research,
Columbus, Ohio.

In a situation such as ours, where mental diagnoses form the basis for practical social adjustments, there is a constant need for critical evaluation of tests as they really throw light on the most significant points of mental status and capabilities. We ourselves for long have been considering test results in the light of detailed case-histories, in the light of what we could learn of developmental conditions, previous education, environment, etc., up to the time of first testing; and later by comparison with further testing and the social outcome.

We feel strongly that, above all things, we need to know, as far as possible, how the findings on tests correlate with results in life. When this is done we find that conclusions often drawn from scheduled averages and norms do not hold true for individual cases, yet it is always just a single individual whose case is presented for diagnosis by the clinical psychologist.

(1) Of the present situation we think as follows: We cannot be satisfied with Binet-Simon measurement alone, even for rough diagnosis, except in cases of low grade feeblemindedness. Many criticisms already made of these tests seem to us to be valid—reiteration of them is not needed—but we may offer a few general points of opinion:

(a) We do not feel satisfied with the separate tests themselves, even for rough diagnostic purposes. We feel that some of them might be replaced by better tests.

(b) We feel certain that, at least for our population, some of these tests are not rightly placed at age-levels.

(c) We feel that at several places these tests depend too much upon language and matters of information are unduly stressed.

(d) We have seen no particular reason for adopting any one of the revisions. None of these seems to show enough advantages over the 1911 series, nor obviate the difficulties inherent in the original. Indeed, some of the objections show even more strongly in the revisions.

Concerning age-level testing in general: We do feel that for certain cases rough interpretation by age-levels is highly valuable, although we are not prepared to say that a percentage grading might not be more justifiable. Of course, we regard as ridiculous the diagnosis of adults in terms of retardation from their chronological age, and we certainly find very definite reasons for disagreeing with the idea that the capabilities of older persons can be evaluated in terms of age-levels of "intelligence." The notion that capacity for giving testimony, or industrial efficiency, or ability in any special field can be

estimated by an ordinary age diagnosis, we find to be erroneous. Many elements of character and of capacity gained by world-experience are not so easily determined.

One important phase of the whole situation seems to us to be that some psychologists think of the possibilities of achievement and conduct in astonishingly and unwarrantably simple terms.

While we somewhat deplore the present lack of close co-operation between clinical psychologists, yet we see certain advantages at this stage through many working according to different methods and using different tests. None of us, as yet, knows sufficient for practical purposes.

(2) Our present procedure: We passed from the 1905 to the 1908 and then to the 1911 Binet series as they appeared. We adopted the latter in order to send to our State School diagnoses on the feebleminded comparable to those made there. In order to keep our records equivalent we are still continuing the 1911 scale. We do not use the point scale because of practical time considerations.

In young individuals and among the lower feebleminded we grade by Binet, plus school work and a few other simple tests. In all other instances we feel the urgent necessity of using a wide range of tests for special abilities, which, we find, begin to vary so greatly at 10 years or so of age. These often have much more significance for social implications than any age-level test. In special cases, such as those presented by the psychoses and neuroses, by defects in self-control, by educational and vocational problems, we vary and often greatly extend our procedure. We then use tests not only from our own series, but from many other available sources. We sometimes outline a detailed psychogram, which contains items of diagnosis and prognosis based on test results and other vitally important findings.

In our situation there is, unfortunately, perhaps, much more chance for a practically critical outlook on the interpretation of tests than for developing norms. Much of the standardizing of our own tests has been done outside of our laboratory. Through constant development of case-studies and follow-up work, we have, and shall continue to have, we hope, much practical and carefully worked-up material for future publication.

(3) Lines for future development of testing: We are convinced that there is need for much further experimentation, both with measuring scales and separate tests. We see many educational and vocational problems which are unanswerable as yet. With the idea often

expressed that there is little need for other tests, the need being only for further standardization, we certainly do not agree.

We believe that there should be steady development of a more critical attitude towards method, taking into account all the various adventitious conditions which may interfere with the examinee achieving the best results.

We also feel that there is much room for development of better interpretations, particularly in the light of years of follow-up work of special cases. Bearing on this is the vital question of how individuals who maintain themselves well in different grades of society react to tests. This problem of norms for social levels is hardly touched and, we fancy, will bring some valuable information when worked at.

(4) If there is to be as rapid advance as possible in the future, there must be much better co-operation between psychologists. It is a crude stage in the development of any science when workers are pulling in different directions and little cognizance is taken of methods and norms established by others. We would heartily favor special conferences on tests and testing.

WILLIAM HEALY AND AUGUSTA F. BRONNER.
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Chicago.

(To be continued in the May number)

THE
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EDITORIAL

THE TALENTED CHILD

Some time ago the superintendent of schools in Munich requested the teachers of certain grades in the entire city to ask each child to draw two sketches: one after a model and the other a free sketch. These were collected and sorted for the purpose of finding evidence of exceptional talent for drawing. A certain per cent. of the children whose exceptional talent for drawing had been thus revealed were sought out and informed of their power and promise, encouraged, and, where welcomed, aided in providing for special education in this field.

What was done in this very simple and inexpensive procedure for drawing could be done for plastic art and for music, within the field of art. It could also be done for special fields of industry which require well-defined talent for successful procedure. The cost would be entirely negligible and the gain would certainly be enormous.

There would be many by-products of such a procedure; the children, the parents, the teachers, and the community would be aroused to a recognition of the significance of the presence of unusual talent. The tests which would serve as a drag-net might well be made of such

a nature as to constitute a high order of training through an exercise in a specific subject. The training of teachers for the making of such tests would be more than compensated for by the stimulus for observation of talent that a specific exercise would give; having sought out one talent, a teacher would thereafter continually be in search for this and related talents which might otherwise pass unobserved. Early discovery of the child would make a specialized education possible at the right time and the child with a spark of genius might well be exempted from the drudgery of the hard and fast curriculum.

It has been said that one cannot suppress genius, but a genius once said something to the effect that most persons die with all their talent in them. Talent is the precious metal of the community and it is as important that we should distinguish the exceptionally talented individual in the early school life as it is that we should make a distinction between our rare and our baser metals. The present testing movement has here a new field somewhat parallel to that of the discovery of the defective and the working out of norms for the normal. It has been said that it is easy to obtain means for the study and care of the defective because you can make people weep over them. Why should it not be equally possible to secure the means for the developing of the exceptionally gifted child for the thrill of joy that a community should have in the discovery of such a possession? The investment will have to be made not so much in specialists or expensive institutions as in regular superintendents and principals who have a vision and know how to use modern means for the conservation of human energies.

C. E. SEASHORE.

NOTES AND NEWS

The London scientific weekly, *Nature*, speaks with approval of the efforts of certain members of Parliament to secure the appointment of a commission to inquire into the condition of education in England, with a view to securing a more adequate preparation for commercial and industrial life and a better adjustment to social and economic conditions. From another quarter dissatisfastion is voiced with the position of science in English education in a vigorous memorandum drawn up by a committee of the Association of Public School Science Masters. Perhaps after forty years of neglect, the counsels of Herbert Spencer regarding the position of science in education are to have some weight with his fellow countrymen, especially when the patent lessons of a world war are adding their reinforcement.

Mr. Stuart A. Courtis, well known for his standard tests in arithmetic, is engaged in perfecting a similar series of tests for geometry. These tests are seven in number including a speed test in copying figures, an exercise in the cancellation of a right triangle among numerous other types of triangle (recognition test), a memory test, a generalization test, an expression test, a logical relations test, and an exercise in stating the converse of a proposition and indicating whether this is true or not. It will be seen that none of these tests is strictly geometrical, and it will be of interest to see to what extent the results correlate with class standing in geometry. In the memory test the pupil is to read the instructions as many times as he wishes before turning the sheet, but after he has once tried to carry out the instructions for any sentence he is not to turn to the instructions again but go on to the next. This situation places a heavy burden upon the pupil's honesty, and the reliability of the results may well be open to question. In the generalization test where the pupil is to indicate the common element in a series of five words, a difficulty lies in that some of the more difficult sets contain more than a single common element. A limited number of these tests are being supplied free to high school teachers who agree to turn over the results to Mr. Courtis.

At the University of Illinois lectures have been given recently before students of psychology and education by Principal Jesse B. Davis, of Grand Rapids, Dr. Helen T. Woolley, of Cincinnati, and

Dr. W. V. Bingham, of Pittsburgh. Mr. Davis explained the methods by which the schools of Grand Rapids were seeking to meet the needs of vocational education; Dr. Woolley explained the work in mental testing carried on by the Vocation Bureau at Cincinnati; Dr. Bingham spoke on "Making Psychology Practical."

During the month of March Professor G. M. Whipple lectured on "The Problem of the Gifted Child" before the Louisville, Ky., Teachers Association, the Southeastern Nebraska Educational Association and the University of Iowa.

The following news notes are taken from *School and Society:*

The Washington educational survey commission has selected Dr. W. C. Bagley, professor of education at the University of Illinois, as one of the two men who will conduct an investigation of the educational institutions of the state.

Leaves of absence at Harvard University have been granted for the second half of next year to Paul H. Hanus, professor of the history of education, and to Henry W. Holmes, assistant professor of education, and for the first half year to Walter F. Dearborn, assistant professor of education.

Dr. Herbert G. Lull of the University of Washington has accepted the position of head of the department of education at the State Normal School at Emporia, Kansas, and director of state training schools.

At Harvard University George E. Johnson has been appointed assistant professor, and John M. Brewer, instructor in education.

G. A. Bricker, assistant professor of agricultural education at Ohio State University, has accepted a similar position in Syracuse University.

PUBLICATIONS RECEIVED

ERNEST J. ASHBAUGH. *Handwriting of Iowa School Children.* Bulletin of the State University of Iowa. Extension Division No. 15. March 1, 1916. Pp. 24.

The author reports the collection of 28,000 samples of hand-writing from 110 cities, towns, and rural schools. The children were asked to write the sentence "Mary had a little lamb" at their natural speed and as well as they could for exactly two minutes. The papers were graded on the basis of the Ayres scale and the results indicated by grades and by groups in grades. Both speed and quality for different types of children are indicated in graphs, and the author concludes that on the average Iowa children write as well as any children of like grade elsewhere in the United States, and that 75 per cent. of eighth grade children are writing a satisfactory quality.

CLARENCE RAY AURNER. *History of Education in Iowa.* Iowa City: The State Historical Society of Iowa, Volume I, 1914, Pp. xiv, 435. Volume II, 1914, Pp. ix, 469. Volume III, 1915, Pp. xii, 464.

This is unquestionably the most complete history of education issued by any state, and in many respects is the most elaborate study of any aspect of educational development in America. The work was undertaken in 1912, and when completed will comprise six imposing volumes. As the editor of the series well says, "that the task of writing the first comprehensive history of education in an American commonwealth should have fallen to one so enthusiastic, so well-trained, and withal so experienced as Dr. Aurner is a matter of good fortune." The first volume presents a general historical introduction, the management of the public school funds, the formation of school districts, the appointment of teachers, and the selection of text-books in the schools. Volume Two traces the history of school supervision in Iowa and discusses state boards, teachers' institutes, teachers' associations, miscellaneous educational activities, and proposed legislation. Volume Three deals with the development of secondary education, taking up the incorporated and the unincorporated academies, secondary schools under sectarian domination, the public high school, and high school courses of study. The work constitutes a model of what a state history of education should be.

EMMA MILLER BOLENIUS. *Teaching Literature in the Grammar Grades and High School.* Boston: Houghton Mifflin Company, 1915. Pp. xv, 337. $1.25.

In his editorial introduction, Prof. Cubberley points out that the early teaching of English was characterized by the effort to inspire

pupils and to awaken in them a love of poetry and prose. This was denominated "snap work" by teachers of mathematics and classics, and under the sting of criticism teachers of English went to the other extreme, reducing their instruction to a monotonous and almost lifeless type of intensive study. At the present time there is a marked reaction against making the study of literature "a grind." The present volume is an attempt to strike a golden mean between the extremes just mentioned. There are chapters on the ballad, the lyric, the metrical tale, the metrical romance, the epic, the drama, the short story, the novel, the essay, and the oration. In each one of these chapters the author takes up representative classics, largely those that have been recommended for college entrance requirements, and indicates how they may be taught so as to bring out the life and zest and interest in these masterpieces as literature. The teacher of English will find many interesting suggestions and valuable devices in the book.

LUCIUS MOODY BRISTOL. *Social Adaptation. A Study in the Development of the Doctrine of Adaptation as a Theory of Social Progress.* Cambridge: Harvard University Press, 1915. Pp. xii, 356.

Part One of this stimulating book furnishes a sociological background drawn from the works of Auguste Comte, Herbert Spencer, and the older sociologists. Part Two traces briefly the history of biological evolution, the Neo-Darwinians, and the environmental school of sociologists. Part Three presents the views of those who hold to a passive spiritual adaptation. Part Four regards even material adaptation as active, and Part Five considers the evidence for an active spiritual adaptation. It is an interesting thing to see the sociologists analyzing the phenomena of our complex social life from the same point of view and by the same objective methods that the biologists have applied in their study of animal life. To what extent the same principles hold is still an unsettled question, but the method of attack upon the problem leads one to hope for far-reaching results.

ROLLO WALTER BROWN. *How the French Boy Learns to Write. A Study in the Teaching of the Mother Tongue.* Cambridge: Harvard University Press, 1915. Pp. ix, 253.

The author in the course of long experience in the teaching of English became impressed with the thoroughness with which the French handled the problem of learning to write, and at the first opportunity spent a year in France for the purpose of studying at first-hand French methods of teaching composition. The present volume recounts the results of this study. There is a detailed discussion of the course of study, the methods of teaching composition, the attitude of the French toward formal grammar, the significance of literature, the

teaching of foreign languages, the preparation of French teachers, and the influence of organized language tradition in France. This latter factor exerts perhaps the most powerful influence upon the boy's developing French style. The lack of this factor in America is one of the chief obstacles with which teachers have to contend.

B. R. Buckingham. *Survey of the Gary and Prevocational Schools.* Extract from the Seventeenth Annual Report of the City Superintendent of Schools, New York City, 1914–1915. New York: Department of Education, 1916. Pp. 61.

At the beginning of the school year 1914–1915 two schools were organized on the Gary plan and six schools on the Ettinger (or prevocational) plan. In March and again in June, 1915, tests in arithmetic problems, grammar, geography, spelling, and history were applied to the eight schools to determine the status of the pupils in these subjects. The tests, the methods by which they were derived, and the detailed scores of the results are given in the report. Eight of the regular elementary schools were included in the experiment for check purposes. In practically all subjects the regular schools make the highest scores, the Ettinger (or prevocational) schools come next, and the Gary schools last. The author is careful to state, however, that the results should not be interpreted as a condemnation of the Gary principle.

A. Frederick Collins. *The Book of Stars.* New York: D. Appleton and Company, 1915. Pp. xv, 230. $1.00.

This book was written to conform to the tests of the Boy Scouts, and the author's sole idea is to show the boy or girl how to become familiar with the heavenly bodies. While the astronomy presented in it is of the simplest sort, the easy style and the abundance of diagrams will stimulate the interest of even the dullest child, and will engender a desire to know more about the subject, and to look up points in larger treatises on astronomy.

Ellwood P. Cubberley. *Public School Administration. A Statement of the Fundamental Principles Underlying the Organization and Administration of Public Education.* Boston: Houghton Mifflin Company, 1916. Pp. xviii, 479. $1.75.

Part One presents a general outline of the subject, and deals with state, county, township, district, and city school organization and administration. Part Two is devoted specifically to the city school district and its problems, including the organization and function of the board of education, the duties of the superintendent of schools, the teaching corps, the courses of instruction, the testing of results, and the various departments of health, attendance, construction,

business, etc., which the modern school system necessitates. Part Three summarizes the results of city administrative experience and applies them to county and state organization. Each chapter is followed by a list of selected references, whose value is distinctly increased by the brief explanatory comment following each reference. The book will be found of great value to the student of educational administration.

CALVIN O. DAVIS. *The Subject-Matter and Administration of the Six-Three-Three Plan of Secondary Schools.* Ann Arbor: University of Michigan Bulletin, September, 1915. Pp. 35.

This is an excellent statement and discussion of the six-three-three plan with illustrative courses of study, comparisons with French and German plans, and a list of the towns that have recently adopted some form of this plan.

E. A. DOLL. *Woolley and Fischer's Mental and Physical Measurements of Working Children. A Critical Review.* Publications of the Vineland, N. J., Department of Research, No. 6, January, 1916. Pp. 20.

This is much more elaborate than an ordinary review, both in respect to the detailed examination of the material and the effort at constructive criticism of the investigation. The reviewer considers the monograph of great social and serious psychological influence, but laments the lack of orientation in the literature of the subject, the inadequate description of the children, and the arbitrary choice of tests.

BENJAMIN DUMVILLE. *Teaching—Its Nature and Varieties.* London: University Tutorial Press, 1915. Pp. vii, 446. 4sh. 6d.

In this discussion the author confines himself to general principles of teaching and does not enter upon a discussion of the teaching of specific subjects. The author presents a general view of education and of teaching, discusses the definitions of teaching as telling and as causing to learn, contrasts object teaching and the teaching of skill, and discusses the teaching of general truths, the teaching of reasoning, and inspirational teaching. While the treatment of the subject is largely philosophical, there are frequent references to the recent literature of experimental education.

The Educational Conference. Volume I, No. 2, 3, 4. Whitewater, Wis., 1915.

This little magazine is published bi-monthly during the school year by the Normal School at Whitewater, Wisconsin, in the interests of the teachers of professional subjects in normal schools. The sub-

scription price is 25 cents per year. In the number at hand are to be found an investigation of courses in the observation of teaching, educational psychology in the normal schools, ability tests at Whitewater, and many interesting educational notes.

WILLIAM F. FEAGIN. *Annual Report of the Department of Education of the State of Alabama for the Scholastic Year Ending September 30, 1915.* Pp. 176.

Perhaps the most interesting feature of this report is the account of the effort which the State of Alabama has been making to decrease illiteracy within its boundaries and to provide compulsory education for its children.

WILLIAM BYRON FORBUSH. *Child Study and Child Training.* New York: Chas. Scribner's Sons, 1915. Pp. vii, 319.

This is a very general treatment of child study, ranging all the way from what complete parenthood involves, through training in obedience, play, work, the bible and the child, the home and the school, amusements, money, and vocational guidance, to the development of religious ideals. An interesting feature of the book is the series of twenty-seven "laboratory experiments," as they are called by the author. These consist of questions and suggestions for the study of such topics as the interests of an individual child, a child's reading, crises in a child's life, the vacation problem, motion-picture shows, and the public library and the children. The book makes no pretensions to scientific treatment but promises to be of help to many earnest workers with children.

VINNIE C. HICKS. *The Hicks Series for Atypical Children.* San Francisco: Milton Bradley Company, 1915.

This is a novel undertaking to provide material for use in the training of defective children. It consists of a series of booklets, each containing about forty pages, with a story printed in large type and every third page left blank for drawings illustrating the story. The first book is entitled "The Farm Family." Others are "The Brown Children at School," "The Chicken Book," "The Action Book," which contains lists of verbs to be used as a game, and "A Number Story Book." "The Action Book" is supplemented by two sentence games, for which the material is supplied on large cards to be cut into small sections, and a set of word dominoes. A "Geography Story Book" is also contemplated. The material, particularly the sentence games and the word dominoes, represents a departure from traditional methods of trying to educate backward children, and promises to be of distinct value in the training of very young normal children. It is to be hoped that the author will follow up the material by the publication of data indicating the results of its application.

MABEL BETSY HILL. *The Most Popular Mother Goose Songs, with Illustrations in Color.* New York: Hinds, Noble and Eldredge, 1915. Pp. 44.

While this edition of Mother Goose may not have quite the artistic distinction of the Volland Edition, it has the distinct advantage of containing on each page the music to which the Mother Goose Melodies are to be sung. Both voice part and piano accompaniment are presented, and the illustrations are grouped very tastefully and artistically about the music.

K. J. HOKE. *Placement of Children in the Elementary Grades.* A Study of the Schools of Richmond, Va. Bulletin, 1916, No. 3. Washington: Bureau of Education. Pp. 93.

The monograph presents the age-grade progress of children in both the white and negro elementary schools, discusses acceleration and retardation, considers the effects of absence and age of entrance on school progress, and discusses the application of mental tests for the placement of children. The last thirty pages of the monograph present a detailed statistical study of the application of the Binet tests to 743 children. The results are tabulated in a variety of ways showing chronological and mental ages of repeaters, of non-repeaters, and of those who have skipped a grade. The work concludes with a strong plea for the more general use of mental tests in placing children in the grades.

H. L. HOLLINGWORTH. *Outlines for Experimental Psychology.* New York: A. G. Seiler, 1914. Pp. 109. $1.00.

This outline has grown out of the author's experiences in teaching, and presents a brief analysis of each section of psychology with a list of selected references after each group of topics. The laboratory manual is designed especially to make use of the abundant material which has been coming from the various Columbia and other laboratories for the last ten years.

F. J. KELLY. *The Kansas Silent Reading Test.* Studies by the Bureau of Educational Measurements and Standards. Kansas State Normal School, No. 3. Pp. 37.

Part One of this booklet gives the three tests, the directions for scoring, and the distribution of the results obtained from applying the tests to 9252 children. Part Two explains the derivation of the tests and the method by which the value of each exercise was determined.

Kindergarten Training Schools. Bulletin, 1916, No. 5. Washington: Bureau of Education, Pp. 62.

A brief history of kindergarten training is followed by detailed statistics of training schools. A two-year kindergarten training course is suggested, and the ideals of kindergarten training are set forth by various eminent kindergartners.

AUGUST C. KREY. *Bulletin for Teachers of History.* University of Minnesota, 1915. Pp. 20. 25c.

This bulletin was prepared at the request of the College of Education to place before high school teachers a succinct statement of the problems connected with high school history and to suggest some of the more important materials and methods for dealing with it. The topics considered are the teacher's preparation, materials for the history course, and devices for the teaching of history.

THOMAS R. LOUNSBURY. *The Life and Times of Tennyson from 1809 to 1850.* New Haven: Yale University Press, 1915. Pp. xvi, 661. $2.50.

This final work of the late Professor Lounsbury deals with the most interesting period of Tennyson's life. The book is the fruit of long and loving labor in a field in which the author stood pre-eminent. Some of the chapters were still unfinished when death overtook him, and the work of preparing the manuscript for the press fell to Professor Wilbur L. Cross. There is a brief sketch of Tennyson's early life, a chapter on his university days, an extended consideration of the literary trend of the period, an account of the poetic productions from 1830 to 1850, and a discussion of the sharp attacks of Christopher North.

ROBERT MACDOUGALL. *The Influence of Eye-movements in Judgments of Numbers.* Reprinted from the American Journal of Physiology, Volume 37, No. 2, May, 1915. Pp. 300–315.

The author's conclusions affirm the influence of eye-movements in our common judgments of number, and lead to the distinction of two types of factors, transitive (differences in color, brightness and size) and resident (the complex of kinaesthetic sensations aroused in connection with perception).

JOHN MACY. *Socialism in America.* New York: Doubleday, Page & Company, 1916. Pp. xi, 249. $1.00.

The problem of the present study is set in the first chapter by the consideration of the attitude of the socialists in the present war. The author recognizes that the war is having a profound effect upon

socialism, and inquires whither it is to lead American socialists. There is a spirited account of American economic history, a statement of the program of the socialist party, a defense of the Industrial Workers of the World, and a plea to American socialists to work in the spirit of internationalism which their European brethren have discarded.

A. C. MONAHAN. *Free Textbooks and State Uniformity.* Bulletin, 1915. No. 36. Washington Bureau of Education. Pp. 67.

There is a history of the free textbook movement, a digest of the laws relating to free textbooks, and a discussion of uniformity within the different states. An appendix recounts the history of the state printing of textbooks in California and Kansas.

WALTER S. MONROE. *The Cost of Instruction in Kansas High Schools.* Studies by the Bureau of Educational Measurements and Standards, No. 2. Emporia, Kansas, 1915. Pp. 35.

The author indicates what is meant by unit of instruction, shows how the cost of a unit of instruction is determined, discusses the factors that enter into such cost, and outlines standards for Kansas High Schools.

ERNEST CARROLL MOORE. *What is Education?* Boston: Ginn and Company, 1915. Pp. vii, 357. $1.25.

The author states that this volume owes its inception to his efforts to teach college students and teachers how to study. In this he finds that one of the greatest needs is an elementary knowledge of the philosophy of education. In this book, therefore, he has attempted to set forth the fundamental presuppositions of education. There is a chapter on the doctrine of general discipline, another on learning by and for doing, and others on learning by problem getting, organization by selection, and learning to work by concepts.

RAYMOND PEARL. *Modes of Research in Genetics.* New York: The Macmillan Company, 1915. Pp. vii, 182. $1.25.

This book is devoted to an examination of the underlying methodological bases of modern genetic science. Chapter One presents a critical examination of current modes of research dealing with the problem of heredity, the biometric method, the Mendelian standpoint, the psychological approach, and the embryological point of view. Chapter Two is devoted to the significance and limitations of biometric methods in biology. Chapter Three considers the nature of statistical knowledge; Chapter Four develops certain logical and mathematical aspects of the problem of inbreeding, and Chapter Five, on genetics and breeding, is a reprint of an address delivered as retiring chairman of the Animal Section of the American Breeders' Association.